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THE RELATIONS BETWEEN THE LYMPHATICS AND THE CONNECTIVE TISSUE.

By W. G. MacCallum,

Associate Professor of Pathology, Johns Hopkins University.

The relation between the lymphatics and the tissue in which they lie and more especially the relations with the connective tissue have long been the subject of discussion. Active interest seems to have arisen, as is often the case, at intervals, in this instance, intervals of thirty years, so that while in the third decade of the past century much was written by Panizza,[1] Lauth,[2] Cruveilhier,[3] and others, a lull occurred until 1862 when v. Recklinghausen's[4] publication of the results of his investigations with the aid of his silver method again fired the enthusiasm of a group of workers, some of whom fell in with his ideas, while others opposed them. This period of activity, lasting many years, also subsided into a quietude only recently broken by the work of Ranvier.[5]

Up to v. Recklinghausen's publications various conjectures as to the possibility of connection of lymphatics with the blood vessels, etc., had been pretty well settled by the injections of Teichmann[6] and others, but as to the nature of the walls there was still doubt, for His[7] expressed his opinion that there were no walls, but that the canals were merely excavated in the tissue. He described the lymphatics in the tadpole's tail with a lining of cells with solid processes, and even states that such a cell might alone form the prolongation of the vessel but never suggested that they formed a wall. Then in 1862 came the monograph of v. Recklinghausen in which, in studies made with the aid of silver staining of tendons and the diaphragm of guinea-pigs and various tissues of frogs, he concluded that the closely anastomosing network of lymphatic capillaries, which he describes very accurately, are lined by a single definite thin layer of flat polygonal endothelial cells whose margins are stained black with the silver. These walls are, however, in a sense incomplete, inasmuch as the lymphatic canals are in much closer relation with the adjacent tissue from the presence of fine channels running among the cells of this tissue and opening directly into the endothelial-lined lymphatics through gaps

[1] Panizza, Sopra il sistema linfatico dei rettili. Pavia, 1833.

[2] Lauth, Essai sur les vaisseaux lymphatiques. Strasbourg, 1824.

[3] Cruveilhier, Anat. descr., T. i, ii, 1835.

[4] v. Recklinghausen, Die Lymphgefässe und ihre Beziehung zur Bindegewebe, Berlin, 1862.

[5] Ranvier, Archives d'Anatomie Microscopique, T. i, p. 137–152. Paris, 1897.

[6] Teichmann, Das Saugadersystem vom anatomischen Standpunkte. Leipzig, 1861.

[7] His, Zeitschr. f. Wiss. Zool., Bd. xii, 1863.

in their walls. Such "*saftkanälchen*" (lymph-canaliculi) he demonstrates as clear spaces apparently continuous with the clear space representing the lymph channel in specimens prepared by immersing the fresh tissue—diaphragmatic tendon, etc.—in a solution of silver nitrate. For the sake of clearness one of his figures is reproduced (Fig. 1). By this method lymph-canaliculi could be demonstrated in all varieties of connective tissues and the apparent connection of these clear areas with the clear areas representing the lymphatics was considered proof of their continuity as spaces, although all efforts to inject them failed.

His,[8] who had previously employed this method in the study of other tissues, was struck and delighted with the clearness of the picture of endothelium thus obtained but

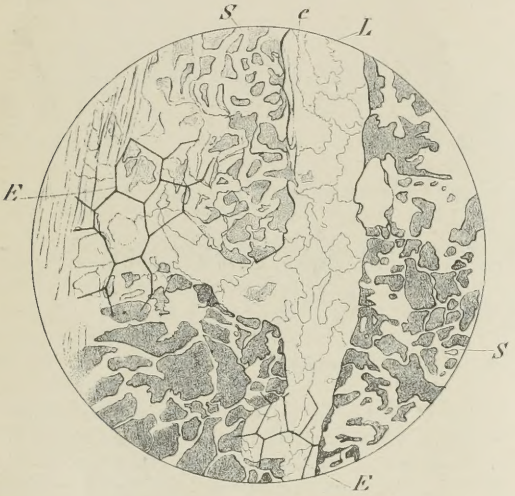


Fig. 1.—From v. Recklinghausen's "Lymphgefässe und ihre Beziehung zum Bindegewebe", Taf. II, Fig. 1. Silver preparation of the uppermost layer of the centrum tendineum of the diaphragm (thoracic surface) of a guinea-pig.

L. Lymphatic-vessel, S. Lymph-canaliculi, e. Outlines of the epithelial cells of the lymphatic vessel, E. Outlines of remaining epithelium of the serosa.

criticised the conclusions of v. Recklinghausen inasmuch as he thought the lymph-canaliculi were an error, that they represented merely the over- and underlying cells which may be stained with silver by treating the diaphragm with strong salt solution after the silver.

Schweigger-Seidel and Dogiel,[9] also writing from Ludwig's laboratory, found no confirmation of the idea of lymph-canaliculi communicating with the lymph channels but thought these appearances due possibly to vacuolation of the cement substance.

Teichmann was one of the earliest defenders of the idea of the complete nature of the walls of the lymphatic vessels, basing his conclusions on the extensive injections which he made. Neumann[10] similarly holds strongly to this idea. Recently Ranvier,[11] injecting the ear tissues in white rats, finds the lymphatic vessels to end blindly and from these and other experiments deduces the idea that the lymphatic system is produced by a long-continued sprouting of blind tubules from the blood vessels beginning at the point of juncture of the thoracic duct and the vein.*

But still all the text-books are full of the idea of tissue spaces in direct connection with the lymphatic radicles and really uniting to form these radicles; whether they are lined with endothelium or not is left undecided but it is suggested that here and there, there are endothelial cells in such spaces. The fluids circulating in the tissues are supposed to be in these spaces and to be thus directly continuous with the fluid in the lymphatics and indirectly with the blood. Wandering cells are supposed to lurk in these spaces and to have ready access to the lymph channels through their porcus walls.

It was with the idea of determining if possible the nature of these relations between the channels and the surrounding tissue that the following study was begun, at the suggestion of Professor Marchand in his laboratory in Leipzig and continued in Baltimore.

It was found that the lymphatics could be readily demonstrated by interstitial injections by means of a fine hypodermic syringe in the skin of embryo pigs which were also the most easily obtained of all animals and although the results have been controlled by experiments with other tissues this was adopted temporarily at least as material for observation.

It is well known that in making such cutaneous injections if one passes the needle through the skin into the subcutaneous tissue a great globule of the injection mass forms at the point and no vessels of any sort are injected. If, on the other hand, the needle is inserted too superficially the injection mass bursts out in a vesicle which elevates the epidermis. If, however, the point of the needle is pushed into the denser translucent skin itself and then withdrawn a very little, pressure on the piston will force the injection mass into the lymphatic vessels which spread themselves out as an injected network of extreme delicacy and beauty. In such injections it sometimes happens that the blood vessels of the skin are entered and injected but this occurrence is not very common. An injection of the blood vessels is very

[8] His, Zeitschr. f. Wiss. Zool., Bd. xiii, 1864.

[9] Schweigger-Seidel und Dogiel, Arbeit aus der Physiol. Anstalt. Leipzig, 1866.

[10] Neumann, Zur Kenntniss der Lymphgefässe der Haut. Wien, 1873.

[11] Ranvier, Loc cit.

*Since this paper was written, Dr. Sabin has described (American Journal of Anatomy, 1901–02, vol. 1, p. 367) the whole development of the lymphatic system from a bud from the vein wall, which shows that Ranvier's surmise was in fact very near the truth. Her work further confirms almost all the results expressed in this paper.

easily recognized macroscopically as it has nothing of the intimate anastomoses which go to form the dense network seen when the lymphatics are injected. Naturally the pressure used in injecting must be very slight as otherwise the delicate lymphatics may be ruptured. In the embryo pig the most beautiful injections may perhaps be obtained in the skin of those measuring from 60-150 mm.; the younger pigs are rather too delicate for manipulation and in the older ones the induration of the skin which comes on toward the completion of gestation renders it difficult to inject any considerable area. Any portion of the skin may be injected, that over the rump and hind legs is perhaps the most favorable. Often in such injections when the cutaneous network is well distended, long, wide and fairly straight trunks may suddenly become marked out, running from the skin to the inguinal or axillary region and evidently meeting there with the glands in those regions; indeed, in very young pigs it has sometimes been possible on inserting the needle deep into the inguinal region at the point where the glands should be, to inject the cutaneous network over the whole side of the pig.

It is not the purpose of this paper to describe the gross relations of the lymphatic channels to the skin, etc., suffice it to say that there is a deeper network of wide anastomosing channels lying in the lower level of the skin from which branches of a narrower caliber rise toward the surface and divide to ramify in these more superficial levels. The channels forming the lower network have the curious pear-shaped segments, so often represented in text-books, which give rise to the somewhat beaded appearance seen in the injected specimens. These are often enough seen to be branched so that there are two or more of the widened and rounded ends and from each of these there springs a new segment or sometimes two, starting as a narrow tube and widening out in turn to form again a bulbous end from which spring new narrow stems. At the bulbous end at the point of origin of the next segment the communication of the first with the second segment is further narrowed by the presence of a valve-like annular septum formed of a double plate of cells which project into the lumen of the canal. The valve action of such an annular septum seems not to be very efficient in either direction, for if the injection be carried out under the microscope the fluid may be seen to pass in either direction. The structures of these valves will be discussed more fully later. The branches springing upward toward the epidermis have not been observed to have this curious segmentation.

These details could be readily observed by tearing off the skin and clearing it for examination microscopically; especially satisfactory is the examination of such objects with the new Greenough stereoscopic microscope.

The tissue in which these vessels lie is seen in sections to be the connective-tissue corium; neither in the underlying much looser subcutaneous tissue nor in the epidermal layer are any injected branches found. The corium is composed of a mass of cells lying in a rich intercellular substance in which run also thin-walled blood vessels. The blood vessels are distinguished from the lymph vessels described above by the stoutness of the cells forming their walls which are very conspicuous even when the lumen is collapsed, by the parallelism of their walls and often by their content of blood (Fig. 2).

The connective-tissue cells are fairly homogeneous, in form they are generally elongated and somewhat fusiform or cylindrical, but from both ends and sometimes the side there spring most numerous protoplasmic processes which are long and rather wavy and run about, twisting among those of the adjacent cells. The cell body is fairly granular and deeply staining. The nucleus, which is elliptical or oval,



FIG. 2.—Section of skin of embryo pig showing a blood vessel and a lymph vessel lying in the connective tissue.

generally shows a nucleolus and in such tissue karyokinetic figures are found with great frequency.

The intercellular substance is homogeneous and is apparently a fluid or semifluid material. It takes an indefinite greyish-pink color in sections stained with hæmatoxylin and eosin.

The blood vessels are very conspicuous objects in such preparations. They run in general toward the surface where they branch out tree-like; everywhere their walls are formed of quite stout endothelial cells with vesicular but deeply staining nuclei. The cell bodies are not very large, so that the nuclei are crowded together, giving the capillary wall a very solid appearance. The strength of these walls may be put to the test by a forcible injection which leaves them distended with the injection mass but without any leakages or

extravasation. In sections the vessels are often empty and collapsed but generally contain some blood.

In sharp contrast with these appear the lymphatic vessels. They may be observed in frozen and unstained sections (Fig. 2), or even in the freshly torn-off skin itself as canals which stand open and constitute wide gaps in the section or clear bands in the complete skin. By staining such a frozen section with hæmatoxylin and eosin the channels are found to be lined by cells whose cell body is quite invisible *en-face* the protoplasm being so clear but whose nuclei are rounded or elliptical and flattened. These nuclei are easily distinguished from those of the surrounding cells by this spread-out flattened appearance which contrasts strikingly with the somewhat fusiform or cylindrical and hence deeper staining nuclei of the others. The contrast between the perfectly transparent cell body without apparent processes and the granular deeply-staining protoplasm and myriad processes of the connective-tissue cells is perhaps even more imposing. If now we immerse a portion of tissue containing such channels in a solution of silver nitrate these lining cells are marked out with extreme clearness, the outlines or intercellular lines being blackened. This object is obtained with much greater clearness by an injection of the canals with weak silver nitrate solution. From this procedure together with the stained sections we have no trouble in concluding that the endothelial cells are irregularly polygonal flat scale-like structures, each with a vesicular nucleus which accommodates itself to the flattening of the cell in being also flattened. The processes of the adjacent connective-tissue cells impinge directly upon these endothelial cells, and indeed in sections which show the outer surface of such cells, there are generally to be seen bits of overlying cell processes. Still it seems that with very few if any exceptions the endothelial cells give off no processes of their own to the surrounding network.

We have then several features to consider in the structure of these channels; first from an anatomical point of view, and later in the light of their behavior under certain normal and abnormal conditions. It has been stated that the lymphatic channels have not complete walls but that they are in free communication with certain ramifying spaces in the tissue ("saftkanälchen") through pores in their walls. To control this statement is one important necessity. It is necessary further to determine if possible in how far the lining cells of these channels are permanently differentiated from the remaining cells. The mode of growth of the lymphatics must be determined. Further problems will arise in the less purely anatomical consideration of these structures.

von Recklinghausen's work was based almost entirely on the preparations obtained by simply immersing various tissues in a solution of silver nitrate; of these the diaphragm of the guinea-pig seemed to offer an especially convincing picture and, indeed, one does see on brushing off the peritoneal and pleural endothelium and then treating with silver a network of vessels lying in a curiously stained tissue. Each vessel is lined with endothelial cells which are sharply outlined in black; the cell bodies are left quite unstained and the vessels therefore stand out as a clear band in the relatively darkly stained tissue, although it is overlaid by a thin layer of this tissue. The irregularity in the appearance of the staining substance is due to the presence of ramifying unstained areas which seem to be quite as truly spaces, and as they run to the lymphatics seem to be in direct connection with them; between such spaces is a brown granular ground substance. Further than this v. Recklinghausen did not go but stated definitely that these clear areas were the tissue spaces or *saftkanälchen* and that they undoubtedly opened into the lymph channels.

More careful study of such preparations does not, however, lead convincingly to such conclusions. By careful focussing it can generally be observed that the "*saftkanälchen*" are on a different level from the lymph channels; moreover the appearance of actual communication of such spaces with the channels is not nearly so frequent as might be supposed from first impressions, and when it does occur it is generally at a point where the outline of the channel is formed in the optical plane, not by the well-stained endothelial line or margin of the endothelial cells, but by the perfectly transparent curved cell body, so that any transparent body in contact with it would seem to be a space in communication with the cavity of the channel. Torn specimens sometimes show the lymph-canaliculi very well but show the torn end of a stained lymph channel projecting from a lower layer of tissue and quite free and independent of them. In one such specimen one could focus on the tissue with its irregular brown staining and apparent spaces and a little lower one reached the well-defined channel projecting free as a complete tube from the margin of the torn diaphragm; a lower focus still again showed tissue with the lymph-canaliculi.

Sections of such a diaphragm mounted without further treatment show a blackish deposit among and outlining the connective-tissue cells and even the muscle bundles, but not often penetrating to the central portion of the diaphragm. The lymphatics appear as sharply outlined tubes lying just on the surface of the musculature in the subserous fibrous tissue. In carefully studied serial sections no openings in the walls of these tubes could ever be seen.

These sections made both in longitudinal and vertical directions showed more than a negative result, however, for when stained with a nuclear stain the clear spaces or "*saftkanälchen*" so sharply outlined with blackish granules proved each to contain a nucleus and protoplasmic cell body. In a word, the silver acts here exactly as in the walls of the lymph channels and stains with its black precipitate the margins of the cells and intercellular substance and the picture of wide lymph channels with communicating lymph-canaliculi represents nothing more than the lymph channels with the unstained neighboring cells impinging upon them and standing out as clear spaces in the mass of irregularly stained intercellular and fibrillar substance (Fig. 3).

This is especially well seen in flat sections of the skin of fœtal pigs treated with silver in which the beautifully branching cells described above are picked out with a margin of silver which marks out all the fine fibrillæ with borders of infinitesimal granules; lying near the gaping lymph channels they seem like finely-ramifying spaces, sometimes when near enough even appearing to open into the lymph channel. A nuclear and protoplasmic stain, however, leaves no doubt as to the true state of affairs, and the smooth-walled lymphatic is left coursing through a mass of cells and stained intercellular substance.

v. Recklinghausen seems not to have injected the lymphatics with the silver solution. Such an injection without further treatment with silver gives in the diaphragm of the guinea-pig an exquisite network of smooth walled vessels with a quite perfect lining of tessellated endothelial cells. The intervening and surrounding tissue is not stained. v. Recklinghausen did inject colored substances but never could he induce any of them to enter the lymph-canaliculi,

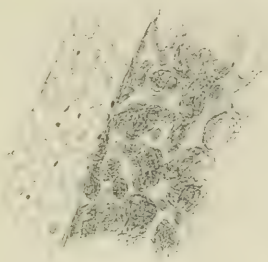


FIG. 3.—Silver preparation from skin of embryo pig. The nuclear stain makes clear the nature of apparent spaces impinging on the lymph vessel.

although as he pictures them the mouths are quite wide. So also various others produced an injection of the diaphragmatic lymphatics by introducing colored substances into the peritoneal cavity of the living animal but always the fact that no structures resembling lymph-canaliculi were injected was most striking. Arnold [12] claims to have injected such spaces in the frog and even in an œdematous frog's leg to have forced injection material from the blood vessels into the lymph vessels by their mediation, but no one has injected them in the higher animals.

From all this it appears that in mammals, at least, the apparent spaces produced by treatment with silver nitrate and named *saftkanälchen* do not represent spaces, are not to be injected or in any other way to be demonstrated to be in connection with the lymphatics, but are cells whose outline has been stained with the silver which is also precipitated in the material lying between them.

[12] Arnold, Virchow's Archiv, 1875, Bd. lxii, 157.

Finally, it would appear that if, as v. Recklinghausen will have it, the tissue spaces are in wide free communication with the lymphatics, in œdema of the tissues the widening of the tissue spaces must be associated with similar widening of their communications with the lymphatics and of the lymphatics themselves in the œdematous area. Injections, however, of the lymphatics in a very œdematous skin or in such tissue as the extremely œdematous gall bladder found in a case of acute nephritis, gave a network of vessels quite as sharply outlined and quite as narrow and free from extravasation as any injection of normal tissue. Indeed, one could not distinguish the network in the œdematous tissue from the normal. Evidently then the tissue spaces are to that extent independent of the lymph channels.

Of course it is not meant to be understood that it is in any way thought that tissue spaces do not exist. It is not conceivable that tissue elements should be so firmly bound together as not to be separable and the simple condition of



FIG. 4.—An extravasation of injection mass through the wall of the lymphatic.

œdema demonstrates with all clearness the separation of the tissue elements with the production of wide tissue spaces. It does seem, however, that these from their nature are variable and instead of being definite cavities lined with endothelium or in direct permanent communication with the lymphatics are dependent for their temporary existence on the separation of the cells and intercellular substances. The mere examination of specimens injected with silver or merely stained in silver is enough to convince one that there are at least no spaces completely or incompletely lined to be found in connection with the lymphatics.

That tissue spaces not in free communication with the lymphatics are abundant seems, however, to be proven by a mode of procedure first employed by Juckuff.[13] He injected paraffin liquid at a low temperature; or, better still, a mixture of paraffin and petroleum ether which remaining fluid

[13] Juckuff, Archiv f. Experimentelle Pathologie u. Pharmakologie, 1893, Bd. 32, p. 124–159.

during injection slowly lost the ether afterward. Such an oily material was injected into the subcutaneous tissues where it formed a great bulla, but if the animal were allowed to live for days or weeks a gradual distribution of the paraffin took place, apparently largely influenced by gravity and the muscular movements, so that it was found on the death of the animal widely distributed and in tissues far distant from the point of injection. Juckuff found that only after a very long time was any trace of the paraffin found in the lymphatics or lymph glands. Repetitions of his experiments have been entirely confirmatory of his results, one obtains as it were a paraffin œdema; masses of paraffin are found in regions of the subcutaneous tissue far distant from the point of injection and sections of such masses with the surrounding tissue show that the masses themselves, consisting apparently of pure paraffin, are in reality the very finely divided areolar tissue between the elements of which lies the paraffin. It is merely a most extensive separation of the cellular elements by the paraffin. The lymphatic trunks draining such a region were not injected nor did the lymphatic glands show a filling up with the paraffin; apparently evidencing the possibility of the injection of the tissue spaces with a fluid without the lymphatics.

We have still to determine whether or not the walls of these lymph channels are quite complete. When injected with silver nitrate the endothelial lining behaves exactly as does that of the blood vessels, and we find in the endothelial margins dots and sometimes circles of black silver deposit which suggest of course that holes have been present and have been the seat of a more abundant silver deposit than usual, or at least that a widening or accumulation of the intercellular material has been present. Satisfactory explanation of these stigmata and stomata is difficult to find. They are often mere dots in the silver line; often much larger round black masses; sometimes they form ring-shaped widening of the lines and then they look more like holes (stomata), still careful examination will generally reveal granules of black within such rings, or even the much attenuated margin of the cell coursing through the center to complete the original silver line interrupted by the ring. So, too, such dots and rings most often with enclosed granules can frequently be found on the body of the endothelial cell away from the marginal line. Injections of Berlin-blue following the silver show no tendency to pass through these rings, and indeed if extravasations of the blue occur they are quite as likely to be at some other point, and, on the other hand, injections of silver nitrate following injections of blue show no especial tendency to produce such dots and rings at the points where extravasation of the blue has occurred.

From these facts it seems fairly certain that such silver markings do not represent holes or any constant structural peculiarity in the walls but are rather accidental precipitations of the silver without especial relation to the anatomical structure.

Efforts were made to observe the endothelial walls in stained sections and this was found to be readily possible in serial sections made parallel to the flat surface of the fœtal skin. Such sections were stained with the ordinary stains and also with the osmic-tannic stain of Kolossow, but although very many walls were searched through, no evidence of pores or holes could be found; sometimes small irregular rents were seen but their inconstancy and irregularity in shape and size forced one to the conclusion that they were merely artefacts.

Mention was made above of extravasation which occurred in injected specimens, and indeed it is almost impossible even with the very lowest pressure to obtain injections entirely without extravasations. When silver is used, as described above, for injection of the diaphragm, extravasations do occur here and there quite irregularly. They permeate the surrounding tissues and at such a point the sharply outlined lymph channel is seen to enter a rounded blur of stained tissue in which the lymph-canaliculi can be readily seen and as readily tested, as described above. Injections with Berlin-blue are especially likely to give rise to extravasations and one often finds the network of injected lymph channels made up in large part of shaggy tubules whose definite outline is almost completely destroyed by the tufted extravasations which are ranged along the margins. This seems to be the most difficult objection to explain away among those brought against the idea of the closed nature of the endothelial wall. Are not these tufted extravasations, it might be asked, merely injections of the lymph-canaliculi through the preformed pores in the walls of the lymphatics? Sections of such injected tissue show, however, pretty definitely that the blue outside of the vessels is in quite irregular masses and is lying quite without respect for the cells of the adjacent tissue which it has pushed aside, sometimes causing considerable damage and destruction of the tissue and often surrounding and including cells (Fig. 4). In other specimens the injection has been so rapid that the blue remains in solution long enough to diffuse in the tissue outside the vessel and cause a blurred blue staining. When it appears as a definite mass outside the lymph channels it is generally continuous with that still inside the main channel by a stalk as it were, and this can in most instances be traced through a definite rent in the vessel wall, which shows then a corresponding bulging (Fig. 4). The picture is quite obviously that which one could produce by forcibly driving the fluid injection through the delicate wall, bulging and rupturing it and invading and pushing aside the tissue outside. In order to control this, similar injections of aqueous Berlin-blue were made under the microscope. This was accomplished by tearing off a piece of skin and laying it epidermis down on a slide on the stage of the microscope and injecting with a hypodermic syringe while observing the entrance of the injection mass. Even before any injection was begun the lymphatics could be made out as clear bands in the tissue quite sharply outlined from the surroundings. On beginning the injection the blue could be seen running along in these channels as a central blue stream, gradually

widening to fill the whole channel; often on account of the extreme richness of the anastomoses the blue could be seen in a given field of the microscope approaching from opposite directions. The valves of the lymph channels seemed to exercise no particular directing influence, for the blue passed from the narrow into the bulbous ends of the segments, or the other way, apparently with equal facility. When the current passed from the tapered end into the widened pear-shaped end of the next segment it was generally seen to eddy about as a central blue current with colorless marginal zones, finally filling the whole channel.

With very low pressure such an injection could be seen to penetrate a certain region of the network without distending the tubules and leaving them as quite smooth-walled canals sharply injected with blue; long continuation or increase of the pressure, however, produced an evident distension of the vessels which nevertheless still remained sharply outlined until suddenly with the continuance of the pressure these could be seen to burst from the wall a bush-like tuft of blue, then another and another quite irregularly; sometimes only one in a whole segment; sometimes so many that the channels were quite covered over with them. The sudden explosive appearance of these tufts seemed to be fairly conclusive evidence of their being traumatic in their nature; forcible extravasations from bursting of the wall rather than the injection of preformed channels. By pressure on a coverslip placed over such an injected specimen, all of the injecting fluid could be pressed out of the lumina of the actual lymph channels, leaving the extravasations unchanged as a sort of blue fringe along the clear empty canals. This surely would not occur if these masses of blue were in communication with that in the lymphatic by preformed channels. In such a case the injection should be squeezed out of one part of the injected system with practically the same ease as from the other parts.

The anatomical evidence then seems to show that the walls of the lymphatics, although delicate in the extreme and easily ruptured by a pressure in injecting which could not rupture the most delicate blood vessel, are still possessed of a complete endothelial lining which shows no pores

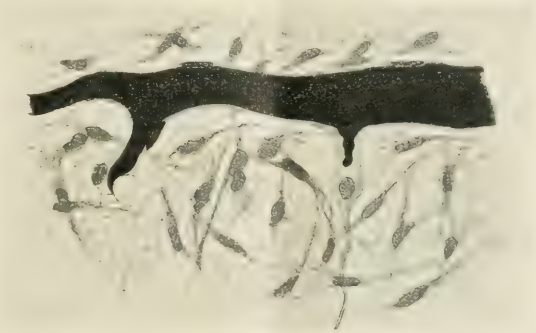


FIG. 5.—Sprouting ends of a lymphatic vessel.



FIG. 6.—Sprouting strand of endothelial cells forming the prolongation of a lymphatic vessel.

or open communication with the surrounding tissue, but is practically analogous with the lining of the blood vessels.

Klein,[14] in his atlas of histology, briefly stated his belief that the lymphatics were developed in much the manner described for the blood vessels, i. e. by the sprouting and hollowing out of endothelial cells. Nowhere else except for the observation of His on the tadpole's tail have I been able to find any expression of opinion as to this point. The thing itself, however, admits of demonstration and the pictures one obtains in the study of these growing points are very beautiful. In sections of the skin of fœtal pigs they can perhaps be seen to best advantage. Here one can sometimes trace the ascending branches of fine caliber from the deeper-lying network into the superficial layers to their ends.



Fig. 7.—Bridge formed by a single row of endothelial cells, connecting two lymphatic vessels.

These ends, instead of being blunt blind structures, taper gradually until the injection mass is lost in a fine filament bordered by two or more relatively thick endothelial cells; sometimes the extreme point is formed by a single cell which sends its long process further on in the direction of the vessel. Such instances of sprouting ends, filled nearly to their points with the injection mass and prolonged by budding cells, often showing mitotic figures, are frequently to be found (Fig. 5).

In other places it seems as if the point of the injected mass corresponds not with the end of the vessel but rather with the point beyond which the vessel is not yet opened, that is one can sometimes trace in sections the sprouting endothelial cells in strands and lines beyond the end of the injection (Fig. 6).

This was the basis of a rather speculative observation among the notes made at the time these sections were studied. It seems probable that the *anlage* for the lymph network is much more extensive than that which can be injected and that this *anlage* forms a series of sprouting bands of parallel rows of cells perhaps easily separable so as to form a lumen; often only single, i. e. not yet divided longitudinally. It differs thus from the *anlage* of the blood system in not being subjected to a pressure which forces apart the cells as soon as possible, producing a lumen.

This process is often illustrated in the formation of bridges or anastomoses between lymph channels, as in Fig. 7, in which the potential channel between the two large injected trunks is as yet composed of only a single row of cells.

The formation of lateral branches by the sprouting of swollen and dividing endothelial cells can be frequently observed; sometimes one can actually observe the hollowing out of a single cell in the earliest stages but oftenest the lumen is formed between the two cells, products of division of a sprouting cell (Figs. 4 and 5).

The process of growth of the lymphatics is thus in every respect analogous with that of the blood vessels with the exception perhaps of the lack of a considerable distending pressure.

As to the question of the specificity of the endothelial cells very little can be definitely stated. There is certainly a morphological differentiation at a very early stage and one does not escape the impression that the differentiation visible thus early is more than a morphological one and that these cells retain their endothelial nature as distinguished from the surrounding connective-tissue cells throughout all the processes of proliferation and development through which they go.

Objections to the idea of the closed nature of the lymphatics have been raised on the ground that their power of taking up solid bodies could not be explained except by the assumption that holes were present in the walls. Thus the

[14] Klein and Smith, Atlas of Histology, 1879–80.

granular matter introduced in tattooing is well known to be gradually carried along the lymphatics and deposited in the appurtenant lymph glands; and similarly any insoluble granular substance distributed in a wound or on a raw surface is to a greater or less extent taken up by the lymphatics. A classical example is the anthracotic pigmentation of the bronchial lymph glands. In no place, however, does it seem inevitable that we should call in the aid of hypothetical pores in the walls, not only because such pores would probably not be effective in aiding the entrance of solid bodies but more especially because there is much evidence to show that the whole process of taking up and transporting such granular material is carried out by the agency of cells which by their independent motility can leave or enter either lymph or blood vessels. That such phagocytism is extremely vigorous and rapid has been demonstrated again and again, and Thoma [15] has actually observed the transmigration of leucocytes from the blood vessels into the lymphatic channels. As Ponfick [16] states, it is wonderful with what rapidity granular material, such as cinnabar, injected into the circulating blood, is engulfed by cells.

If one observes the mesenteric vessels of a frog while injecting cinnabar into the lateral abdominal vein in small quantity the red granules are seen to float free in the blood current only for a very few minutes, generally less than five, then gradually all the granules are found to be floating along surrounded by a mass of translucent protoplasm which represents the body of one or of several leucocytes which have acted as phagocytes. Such leucocyte masses with central pigment block may float in the current for a long time, finally often sticking in some small vessel. Single leucocytes with a pigment granule may emigrate from the vessel and settle themselves somewhere in the tissue; probably a transfer of the pigment to fixed tissue elements, such as the endothelial cells of the spleen and bone-marrow, soon occurs. We have therefore little reason to believe that free granular matter would be left to find its way unaided into the lymphatics; far more probable, in fact almost unavoidable, is the idea that it is carried in by phagocytic cells.

Injection of granular pigment into the subcutaneous tissue of rabbits showed, after a number of days when the rabbits were killed, pigment in the neighboring lymph glands and strewn along the lymphatic trunk in the line of these glands. Sections of such a trunk and gland showed relatively little free pigment; almost all the granules were enclosed in cells.

The injection of carmine in solution into the blood of living animals produces an injection of the lymphatics of the mesentery accompanying the blood vessels. In such a case the carmine seen in the lymphatics is granular but this is possibly from subsequent precipitation. Such experiments seem not especially instructive because one cannot be sure that the carmine does not remain in solution and in the transfusion of solutions through the walls of vessels there is no difficulty.

The writer looks forward to a continuation of the work on this theme in the study of the conditions existing in various other tissues and organs and especially in the application of the results to the study of various pathological processes.

[15] Thoma, Die Ueberwanderung farblosen Blutkörper von dem Blut in das Lymphgefasssystem. Heidelberg, 1873.

[16] Ponfick, Virchow's Archiv, 1873, Bd. xlviii, p. 203.

It is a pleasant duty to write here an expression of thanks to Prof. Marchand for the suggestion of the subject for investigation and for the help which he gave while it was being carried on in his laboratory.

THE ACCURACY OF CERTAIN CLINICAL METHODS.

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In the opening address of a recent German medical congress, its president, comparing the instruments used in the diagnosis of disease at the beginning of the nineteenth century with those which the scientific inventor and the inventor of scientific instruments of to-day claim are necessary, said, "then could the practitioner say with the old philosopher Bias, 'Omnia mea mecum porto,' or, with greater truth, 'nihil mecum porto,' for he had to rely on his five unaided senses—now a Hercules could not carry all the appliances, even the so-called transportable ones, which in diagnosis are at our disposal, to say nothing of those found only in clinics and laboratories." This which is true of physical apparatus is even more so of the clinical and biological knowledge at the disposal of the practitioner of to-day. Then were used the simplest chemical tests, among which taste was not of least importance; now a person would needs have encyclopedic knowledge to measure up to the standards of the specialists in the various branches of science which have advanced medicine so markedly during this century. The well-trained doctor of to-day usually has, as firm foundation, thorough training in one of these sciences; either he was a well-trained chemist, or a well-trained physiologist, or path-

ologist before he began to specialize in clinical medicine; and nearly every one whatever his training may be likes to be considered well read in one of these or kindred subjects, although to keep up in one branch is hard, even for the specialist in that department; and especially is that true of chemistry. But many desire not only to be well up in clinical chemistry, e. g., but to contribute to the progress of that science, and it is with the hope of aiding some of these that this paper is written.

In the course in clinical chemistry and microscopy given at the Johns Hopkins University the following plan has been adopted. With each instrument of importance and each quantitative method of value the student must not only be familiar, but in the use of them, skillful. In the chemistry courses required for admission to this medical school each student has learned the principle on which most of these methods rest, and in most cases has already used these same methods. In the course in physiological chemistry the student learns the quantitative methods of that branch of chemistry, hence the course in clinical chemistry may teach no new method. It does, however, try to train the student in these methods until his work is accurate. The need of this is self-evident. There is a great deal of difference between knowing how to do a thing and the ability to do it well. During their fourth year the students as clinical clerks must use these methods and then is no time to practice. Since the use of thirteen blood instruments and about that number of methods of quantitative determination of various bodies in the urine and gastric contents are to be thus practiced, the work required is not small; and this is really the minor part of the course, since it is in addition to a great deal of qualitative work, which is new, and the examination of many specimens of various nature. The class works in pairs. The blood instruments are passed from one pair to another outside of class hours. The quantitative chemical work is done in class hours, enough apparatus being provided that the whole class may work at the same time. These pairs work independently and hand in their written results. These are tabulated, and the work is repeated on other days, usually three in all, until the results agree satisfactorily.

To publish the results of such work may at first glance seem of doubtful value, for not only is one method under examination, but at least thirty different sets of apparatus, and the chemical training and personal equation of a class of sixty different students. But therein lies the value of such tables of results for the practitioner who wishes to follow, for instance, the phosphoric acid in a series of cases: he must use still another set of instruments; he also has a personal equation, and I very much doubt that his skill will surpass that of two of our students who have used this method at least two or three times before (we shall not publish their first results) and whose pride is aroused that their results shall be within the limits accepted as satisfactory. They seldom know what answer their neighbors are getting, but each one sees the error in technic that his partner makes and insists that that step shall be repeated.

If it be asked what practitioners have the time and inclination to do such work, we answer many, judging from the interest they as visitors and graduate students take in these subjects.

That the worker should have some idea of the accuracy of a method he wishes to use, also of his accuracy as a worker, is most important. Absolute accuracy is still an ideal in chemistry, but the antithesis of absolute accuracy is, I am afraid, "clinical accuracy." By clinical accuracy we mean that taught in many text-books of clinical chemistry, that advertised as attainable by some clinical instruments, that obtained by most clinical workers. Some text-books are evidently written for those with no previous chemical knowledge or training, hence the directions for a given quantitative method are "simplified," some little steps omitted, reasons for nearly all to be taken not given, hence those little technical details the intelligent observance of which is so necessary in accurate work, are not followed, and the result must be only "clinically accurate." In proof of this let the reader compare the directions for a quantitative procedure in many text-books with those given in Neubauer and Vogel's Analyse des Harns, or other standard works on chemical analysis, and he will find the surprising thing that the more advanced the training of the workers for whom the book was written, the more minutely are the directions given.

Then, again, some instruments on the market are advertised or best described as "clinically accurate." They are made in large numbers and are not carefully standardized. The 10 ccs. mark does not mean just 10 ccs., the figure 70 per cent may indicate a color nearer 60 per cent, etc. The makers say they are "accurate enough for clinical work." True, the clinical chemist seldom wishes to know nearer than 10 per cent of the accurate amount, and accuracy of even that degree often seems an unnecessary refinement since the body in which he is interested may increase 500 per cent or more. "Is it rising or falling" is all he usually asks. Well and good. Let him understand that such results are only approximate, but that so are the results he gets by some long expensive method which is still a clinical modification of a good chemical procedure, and which he calculates to the third decimal point, thus showing his confidence in their accuracy.

If thirty separate determinations of the same substance be made independently by thirty persons or pairs of persons, the variations will be greater than one would, at first thought, expect, and yet those getting results somewhat divergent from the others (not the most so) will say with an injured tone, "I repeated the determination three, four or five times and got exactly the same result each time." To make control tests of one's own work, always essential, may show a worker how accurately he works, not how accurately he applies a given method. The inaccuracy of instruments will explain some, but by no means all of the variations in results

obtained by several instruments; but most important is the personal equation of the various workers. By this we mean the difference in skill shown in their work, and in volumetric analysis especially, the difference in idea as to what the end reaction is; and unless a worker has himself standardized the various solutions he uses, it is hard for him to know just what to call an end reaction, for in some of the analyses used in clinical chemistry the end reaction is not a sharp one, and concerning it the element of judgment is very important. In the following report only a few tables are given, and those chosen are the most characteristic, not necessarily the best. The class always had qualitative work on hand or interesting specimens to study, hence not all did their quantitative work on the same day, hence the difference in the number of determinations handed in. But in each table every result is given which was handed in, including the worst. Another point to be emphasized is that each determination recorded is the work of different students. In no case have two results by the same persons been included. We do not print these to show how accurately the work can be done—to show that one student would have been asked to make a series of control tests and the accord of his results would have surprised even himself; but to show how great variations will be found in the results of twenty to thirty independent determinations, that the reader, if he were not previously a student of chemistry, might ask himself, "where in that table would my result have stood," and since only one result of any determination can be correct, "how far are mine, which cost so much time and in which I place such confidence, how far are they from the correct one?"

In the following columns we cannot attempt to give a full discussion of a subject, the technic of a method, etc.—this can be found in any good text-book of chemistry, not clinical chemistry—but to speak of the accuracy of these methods.

BLOOD INSTRUMENTS.

1. BLOOD COUNTING. a. *Thoma-Zeiss Apparatus.*—This method is in such general use, the technic and limits of accuracy so well discussed in the several text-books of hæmatology, that here it will receive but passing notice. The satisfactory use of this instrument requires practice—one can easily see the results of even a few weeks' vacation, and will make two or three counts before his technic becomes again satisfactory. The greater the adroitness in filling the mixer and the cleaner the slide and cover-glass, the fewer the cells which need be counted. Our students are taught to count at first twice the necessary number of unit squares and only diminish that number as they find the figures of the last units do not change the average. One point not enough emphasized in text-books is that the whole blood-covered area of the ruled slide should be examined first with low power, and no matter what distribution obtains over the ruled square, if over the whole field the cells are not quite uniformly distributed, the slide should be cleaned up and another drop examined.

In leucocyte counting the students are taught to make up a fresh acetic acid solution for each day, since single yeast cells often are counted as leucocytes. They are given a bottle of glacial acetic acid and another empty bottle with a label stating how many drops of the acetic acid must be added to the bottle filled to its neck with distilled water to give the desired percentage (0.5-1 per cent). They are also taught to use the 1:10 mixer when leucocytes alone are to be counted.

b. *Oliver's Hæmocytometer.*—This ingenious little instrument has been often considered merely an easy method of getting an approximate blood count. Oliver expressly states that he intended it as a more accurate method than the Thoma-Zeiss as ordinarily used, and invented as a means of detecting slight physiological variations of normal blood which would have escaped notice in the usual method of blood counting. It was standardized by comparing it with blood counts in which very many squares were counted (120), far more than could be counted in clinical work. The author distinctly warns that the instrument is inaccurate in the anæmias and recommends that its use be limited to normal cases. But the clinician has no interest in normal cases and it seems unfortunate that such an easy method should not be used in the abnormal cases, in which alone he is interested, hence it has been used and its use recommended for such cases. In testing this instrument for normal blood, several independent observations were made by as many persons on the same case at the same time, and the blood counted for the most part by the writer. The students were in this case for the most part picked students, that the instrument might receive as fair a testing as possible.

A few of the results are given below. It should be remembered that each reading given is a separate determination—in no case are two readings of the same blood mixture given or two by the same person. Two instruments were in use.

Case.	Oliver's Hæmocytometer.	Thoma-Zeiss.	Difference.
I.	6,000,000	5,587,000	413,000
	5,900,000		313,000
II.	5,800,000	5,675,000	125,000
III.	5,650,000	5,650,000	
IV.	5,500,000	5,400,000	100,000
V.	5,750,000	5,250,000	500,000
VI.	5,500,000	5,300,000	200,000
VII.	5,650,000	5,450,000	200,000
VIII.	5,350,000	5,420,000	−70,000
IX.	5,600,000	5,616,000	−16,000
X.	5,800,000		−36,000
	5,600,000	5,836,000	−236,000
	5,200,000		−636,000
XI.	4,900,000	5,100,000	−200,000
	4,950,000		−150,000
	5,125,000		25,000
	5,050,000		−50,000

Case.	Oliver's Hæmocytometer.	Thoma-Zeiss.	Difference.
XII.	5,050,000	5,300,000	—250,000
	4,950,000		—350,000
	5,000,000		—300,000
	5,100,000		—200,000
	5,050,000		—250,000
XIII.	5,550,000	5,332,000	218,000
	5,500,000		168,000
	5,550,000		218,000
	5,500,000		168,000
	5,475,000		143,000
	5,150,000		—182,000
	5,200,000		—132,000
XIV.	4,700,000	4,916.000	216,000
XV.	5,487,500	5,228,000	259,500
	5,228,000		

It will be seen that several persons determining the same blood independently will get results which sometimes agree markedly, and that these results agree well with the actual count. But these cases were fairly normal.

As soon as we began to study the anæmias a different state of affairs was found. Sometimes the count given by the Oliver instrument was too high (in the pernicious anæmias), sometimes too low (in chlorosis and the secondary anæmias).

I. Anæmia Splenica.

Oliver's Hæmocytometer.	Thoma-Zeiss.	Difference.
3,500,000		—188,000
3,800,000	3,688,000	112,000
3,900,000		212,000
3,700,000		12,000

In this case the results were fairly satisfactory.

II. Malarial Anæmia.

2,100,000	2,800,000	.....
2,100,000	Count was made	.....
2,100,000	on following	.....
2,400,000	day.	.....

III. Chlorosis?

3,900,000	3,520,000	380,000
3,850,000		330,000
4,000,000		480,000

The diagnosis of chlorosis was made from the clinical history of the case: a young woman previously treated here for chlorosis. The entire blood picture suggested pernicious anæmia.

IV. Pernicious Anæmia.

3,900,000	1,725,000	2,175,000
3,675,000		1,950,000
2,850,000		1,125,000
2,850,000		1,125,000

V. Pernicious Anæmia. Same case as IV but some time later.

2,800,000	1,256,000	1,544,000
2,900,000		1,644,000
2,750,000		1,494,000
2,775,000		1,519,000

At this point Dr. Baumgarten began a closer study of the instrument. His results will be found in the BULLETIN of the Johns Hopkins Hospital, July, 1902, to which the reader is referred. Briefly stated, he found the errors due to the coagulation of the plasma and to difference in size of cells, so great that the instrument cannot be recommended for clinical work.

c. *The Hæmatocrit.*—We find this instrument useful in determining the presence of lipæmia, cholæmia, hæmoglobinæmia, etc, but not to count the cells.

2. HÆMOGLOBINOMETERS.—Much time was spent by the class practicing with five of the hæmoglobinometers now in general use, the v. Fleischl, Miescher, Dare, Gower, and Oliver instruments. Comparative tests with these instruments are of little use, for two questions are to be answered concerning each: Is the idea on which the instrument is based a good one? Do the instrument makers furnish a good instrument based on this idea? These two points should be clearly kept in mind. The v. Fleischl instruments are I think excellently made, yet they are fast going out of use because of the sources of error inherent in the instrument. The excellent Gower's instrument, on the other hand, has been brought into much disrepute since the market is flooded with worthless specimens. The scales of hæmoglobinometers can with difficulty be compared. One maker considers 13.88 grms. of hæmoglobin per 100 ccs. of blood normal and makes that 100 per cent, another uses a little higher amount, and some instrument makers seem to guess at it.

It is much to be desired that soon no instruments will read in percentages, but all in grams of hæmoglobin per 100 ccs. of blood. The former method is artificial and is now being abandoned. Supposing we call 13-14 grms., normal for an adult 25-45 years of age. Since a child from 6 months to 5 years of age has normally but 10-11 grms. per 100 ccs., an instrument made for children's blood must call that 100 per cent. Examine such blood with an instrument graduated on the 13-14 grm. basis, that in general use, and the reading would be 75-80 per cent; in the case of a child 5-15 years, 80 per cent; 15-25 years, 88 per cent; and 45-60 years, 87 per cent (Stierlein, Arch. f. kl. Med., XLV, 1889).[1] Yet in each case the blood is normal for that age; i. e., really 100 per cent. I remember the remark a practitioner made concerning chlorotic girls, that it was easy to get their blood to 85 per cent but very hard to raise it to 100 per cent, which would be to give it an abnormally high content of iron. If the method of expression, "grams per 100 ccs." were used, not so many patients would seem to be a little deficient in hæmoglobin, for we would be more likely to bear the age scale in mind.

a. *v. Fleischl Hæmoglobinometer.*—This formerly much-used machine is now less a favorite. Its expense, size, inconvenience in use, but especially its many sources of error (which are very well discussed in many text-books of clinical examination of the blood, Sahli, Cabot, Ewing, Da Costa), have all diminished its popularity.

b. *Miescher's Modification of v. Fleischl's Hæmoglobinometer.*—This is an excellent instrument, the sources of error in the Fleischl are practically all removed, and probably it

[1] Quoted by Sahli.

is to-day the most accurate instrument we have. But its use requires practice, good technic, and longer time than is available in the case of a practitioner, hence it will remain a laboratory instrument. It reads grams per 100 ccs.

c. *Gower's Instrument* is an excellent one when well made. Sahli recommends it above all others to the practitioner. I first learned its value in a large German clinic where the director told me they used only that, since it was certainly superior to the Fleischl. Yet the latter is a German, and the former an English instrument. It is neat, easy to use, and quite accurate. But much care must be exercised in buying it, for the emphatic language of Sahli is justified, who advises his readers to obtain their instruments from the dealers he mentions, since several manufacturers are supplying the market with instruments made in a dishonest manner and unfit for use, which, both as regards their calibration and the quality of the color solutions, would not satisfy the requirements of a person with the most modest expectations. We thought as much once, on receiving six with tubes of various shades.

d. The *Dare instrument* is a new hæmoglobinometer which promises to replace many of the others. Its ease in use and the sound principles on which it is based will perhaps give it first place among the practical instruments and perhaps among the scientific ones. One point much in its favor is the ease in reading slight differences in per cent of hæmoglobin, as is shown by the agreement in readings of two persons of one specimen of blood; or, what is more important, the quite marked agreement in readings of several persons each using a separate instrument, or at least different blood drops. The following are hæmoglobin determinations made with the Dare instrument, the determinations made independently by different persons either with different instruments or each with fresh specimens of blood of the same case at practically the same time. Those used to other instruments and who remember the difference of opinion two persons may have in reading even the same blood mixture, will appreciate these few figures.

Case.			
I.	Four instruments in use.	—85, 85, 88, 88, 87.5, 87, 89 per cent	
II.	Three	"	" 72, 71, 69, 69, 75 per cent.
III.	Two	"	" 86, 85, 87, 90 per cent.
IV.	Two	"	" 85, 85.5 per cent.
V.	Two	"	" 99, 97 per cent.

And yet the Dare instrument has its weak points. The pipette plates are evidently easy to break in using the instrument, judging from the number broken in the use of our six during the past year. The readings must be made at once before the blood coagulates, which sometimes means rapid work.

e. The *Oliver instrument* has some advantages over the Fleischl but we could find none over the Dare.

The *Talquist scale* was little used because we desire an accuracy greater than it advertises to give, and yet I dare say the experienced eye will, with this simple, cheap affair, get more accurate results than many less trained persons can with the Fleischl.

Gastric Analysis.

In all clinical chemistry there is perhaps no subject in which quantitative determinations are of greater value and are easier to make than that of gastric diseases. The apparatus is simple, the fluids few, and the time required short. What is of greater importance is, however, the fact that the results obtained are of considerable value in diagnosis, are, in fact, indispensable. The points to be determined in all cases are: (1) total acidity; (2) if free HCl be present, its amount; (3) if no free HCl be present, how much must be added before the test for free HCl can be obtained, i. e. the HCl deficit. Several other quantitative tests are valuable in certain cases. Knowing these few figures, much is known concerning the gastric juice, the nature and degree of the disease, the motility of the stomach, etc. In the following determinations one-tenth normal NaOH and HCl were used, and the results are expressed in number of cubic centimeters of these solutions used. These multiplied by 10 would give "acidity per cent," and multiplied by .0356 would give the percentage by weight of HCl, since in all cases 10 ccs. of gastric mixtures were used. The indicators used were phenolphthalein for total acidity, Congo red paper, dimethylamidoazobenzol, and Günzburg's reagent for free HCl.

In the case of *phenolphthalein* there should be very little difference of opinion concerning the end reaction. The examination of Tables I and II will show this to be the case, yet in Table III, in which every figure is the result of very careful work, there would seem to be considerable. The reason was that in the case of the first two tables the students were directed to consider the first permanent red tint the end reaction. In the case of III, those getting the higher figures informed me they had followed the advice given in very good text-books, to add the alkali till the deep red fails to increase. Hence, in so simple a test as total acidity the magnitude of the result will depend to some extent on the text-book used.

Congo red paper is an indicator for free acid, and an excellent one, not enough used, for where free HCl is present (as shown by other tests) the amount of free organic acid likely to be present will not disturb results, and yet the end reaction is one concerning which there may be considerable difference of opinion, as the table will show. For routine work it is the indicator used in as prominent a clinic as Riegel's (see Riegel, Die Erkrankungen des Magens). I imagine the wide variations in our work are due to differences in paper and the desire to be very accurate indeed, for the wet paper may look bluish.

Dimethylamidoazobenzol is an indicator for free HCl which promised well at first, but now is less used, although Hemmeter, Simon, and others, think it should replace the others, since it is "both simple and sufficiently accurate for clinical purposes." It is very easy to use, but I think it safe to say that in many clinical laboratories which make a specialty of

gastric analysis it is not used except as an approximate indicator, yet perhaps sufficiently accurate for clinical purposes. The end reaction is not sharp.

Günzburg's (phloroglucin-vanillin) reagent is the best, the most sensitive, the surest, indicating nothing but free mineral acid, i. e. free HCl. Applied in the way suggested by Sahli (adding 25-30 drops of indicator to 10 ccs. of gastric contents and warming the drop on the stirring rod after each addition of NaOH solution) it is by no means a time-consuming procedure, although it is not difficult to use the porcelain dish as usual, as the class did, and the certainty of the result renders it a most satisfactory reagent.

Examination of the annexed tables will show several facts: First, that in no case do all agree when the end reaction is reached; second, that there is greater unanimity of opinion concerning Günzburg than either of the other two; and lastly, that although it is the most delicate test, the amount of HCl indicated by it is less than by the others, and in the case of an HCl deficit, the deficit indicated by Günzburg is the greatest, showing that in the case of the artificial mixtures examined, Günzburg's reagent is less influenced by other constituents of the mixture than are the others.

Although there is some good opinion to the contrary, I think that the weight of evidence is much in favor of Günzburg's reagent as the best indicator in HCl determinations, when accuracy is desired, and that these few tables show that more constant results are obtained by its use than by the others.

The mixtures examined were solutions of Witte pepton, to which the desired amount of HCl was added.

Again, we repeat, the same student was not concerned in any two determinations. Each is the work of a pair of students, all the pairs working quite independently.

Gastric Analysis I.

Total Acidity.—2 determinations gave 8.5 ccs. $\frac{n}{10}$ NaOH.
2 " " 8.6 "
4 " " 8.7 "
5 " " 8.8 "
6 " " 8.9 "
1 " " 9.1 "
Hence, of 20 determinations 15 gave 8.7–8.9 "
Greatest difference 9.1—8.5=0.6 ccs.

Free HCl.

a.—Congo red as indicator.
5 determinations stood between 2.9–3.9 ccs.
6 " " 4.0–4.9 "
8 " " 5.0–5.8 "
Difference of extremes 5.8—2.9=2.9 "

b.—Dimethylamidoazobenzol.
13 results stood between 4.1–4.9 ccs.
7 " " 5.0–5.4 "
Difference of extremes 5.4—4.1=1.3 "

c.—Günzburg's reagent.
15 results stood between 2.2–2.9 ccs.
3 " " 3.0–3.3 "
Difference of extremes 3.3—2.3= 1.1 "

Gastric Analysis II.—HCl Deficit.

Total Acidity.—6 results stood between 5.1–5.5 ccs. $\frac{n}{10}$ NaOH.
8 " " 5.6–6.0 "
1 result was 6.6.
Of these 10 results stood between 5.5–5.8
Difference of extremes 6.6—5.1=1.5 ccs.

HCl Deficit.

a.—Congo red paper.
7 results stood between 0.5–1.9 ccs. $\frac{n}{10}$ HCl.
3 " " 2.0–2.9 "
6 " " 3.0–3.9 "
4 " " 4.0–4.3 "
Difference of extremes 4.3—0 5=3.8 ccs.

b.—Dimethylamidoazobenzol.
1 result was 0.6
9 results stood between 2.0–2.9
7 " " 3.0–3.9
1 result was 4.4
1 " " 5.1
Difference of extremes 5.1—0.6=4.5 ccs.

c.—Günzburg's reagent.
6 results stood between 3.6–3.9 ccs. $\frac{n}{10}$ HCl.
12 " " 4.0–4.5 "
Difference of extremes 4.5—3.6=0.9 ccs.

Gastric Analysis III.

In the final examination in clinical microscopy and chemistry was the following question: "Determine the total acidity and the free HCl or HCl deficit, whichever the case may be, of the given fluid. Use whatever method you choose." Each student worked independently and we may be sure did each determination at least twice, since accuracy in use of any method used was the element under examination. The following is a record of the entire work done, some using but one, some all three methods for HCl.

Total Acidity.
23 determinations stood between 18.1–18.9
26 " " 19.0–19.7
Difference in extremes 19.7—18.1=1.6

As already stated, their idea of the end reaction varied, some stopping at the first red, some at the point at which the red ceases to deepen.

Free HCl.

a.—Congo red paper.
3 determinations stood between 10.0–10.9 ccs. $\frac{n}{10}$ NaOH
5 " " 11.0–11.9 "
5 " " 12.0–12.9 "
Difference between extremes 12.9—10.0=2.9 ccs.

b.—Dimethylamidoazobenzol.
2 results stood between 10.0–10.9 ccs. $\frac{n}{10}$ NaOH
7 " " 11.0–11.9 "
8 " " 12.0–12.9 "
4 " " 13.0–13.9 "
3 " " 14.0–14.3 "
Difference between extremes 14.3—10=4.3 ccs.

c.—Günzburg's reagent.
15 results stood between 9.4–9.9 ccs.
10 " " 10.0–10.5 "
1 result was 12.6 ccs.
Of these, 20 results stood between 9.7–10.2 ccs.
Difference between extremes 12.6—9.4=3.2 ccs., and excluding the one evidently wrong result, 1.1 ccs.

Should the objection be urged that the above solutions lacked many constituents and properties of real gastric contents our answer is that since this is so the errors in the analysis should be less. To test total acidity is an easy, accurate method. The amount of HCl free or deficient is not difficult to determine and if Günzburg's reagent be used, quite accurate.

Urinary Analysis.

Of the many valuable quantitative tests for different constituents of the urine, the few following ones are chosen:

Uric Acid.—Many still think the determination of this acid very important, although the many charges against uric acid in the court of pathology have been withdrawn one by one till scarcely any remain. In class work and also for the practitioner the best method, the Ludwig-Salkowski, cannot be used, and of the permanganate methods the Folin modifications of the Hopkins method are the best. Folin's two modifications were used in class work. A description of the most recent (Zeit. f. phys. Chem., Vol. XXXII) can be found in Simon (Manual of Clinical Diagnosis, 4th ed.) In this method the phosphates and an unknown mucoid body are first removed by precipitation with uranium acetate, after which the uric acid is precipitated by the ammonium sulphate which was in the same solution with the uranium acetate, by adding ammonia. This method has been given a critical examination in this clinical laboratory by Dr. Baumgarten, who finds it is not all that might be desired and whose work will appear later.

In the case of the following determinations, one specimen of mixed urines was collected and the uric acid determined half by the former Folin method, half by his later method.

The answer is given as grams in 1 liter.

Urine I.
Folin 1st method.
1 result was .397 gms.
4 " stood between .400–.449 gms.
4 " " " .450–.499 "
12 " " " .500–.532 "

Folin 2nd method (same urine.)
1 result was .385 gms.
3 " stood between .400–.449 gms.
12 " " " .450–.499 "
6 " " " .500–.544 "

Urine II.
Folin 1st method.
12 results stood between .523–.599
9 " " " .600–.700
Difference between extremes .700—.523=.177 gms.

Folin 2nd method (same urine.)
9 results stood between .249–.299 gms.
8 " " " .300–.344 "
Difference between extremes .344—.249=.095 gms.

The determination of uric acid by this or any method requires good reagents and good technic, and I was surprised that the results came as closely as they did. The advantage of the second method is claimed in the case of pathological urines, in which case the bodies removed by uranium acetate disturb the determination. The chief sources of error are first the reagents, for the ammonium sulphate should be chlorine free, and some of the salt sold under that name is not. The ammonium urate precipitate must be washed with 10 per cent ammonium sulphate solution till the filtrate is quite free from chlorine, or the error will be considerable; and lastly, but of most importance, the end reaction must be thoroughly understood. It is in this case no very sharp point, hence according to the directions given in one textbook the red color should remain at least 30 seconds; in another, the end reaction is the first red color throughout the whole mass of fluid; again, 5 seconds is the limit. The rule of the pure chemist to titrate to color is a hard one it would seem for the clinical chemist to follow, yet this difference in time limit of reaction may mean .03 gms. per 1 liter, in some cases perhaps more. The use of uranium acetate in the latest method of Folin does seem to make the end reaction sharper.

Chlorides.—The volumetric determination of the chlorides by means of the Volhard and Falck method is one of the most satisfactory which the clinical chemist is called upon to do, because of its accuracy. This method was practiced by the class both as recommended by Arnold (Neubauer and Vogel, Analyse des Harns), and by Lütke (Sahli, Klinische Untersuchungsmethoden). The advantage of the latter is that the silver nitrate, nitric acid, and iron alum, are all in one solution, hence the separate bottles for, and separate addition of, the two latter are dispensed with.

In the following table are the separate determinations of the chlorides in one specimen of urine, both methods being used. The answer is given in percentage of sodium chloride, i. e. grams per 100 ccs.:

Arnold method.
2 results stood between 1.26–1.29 per cent.
7 " " " 1.30–1.35 "
14 " " " 1.36–1.40 "
of these 18 " " " 1.34–1.39 "
Difference between extremes 1.39—1.26=0.13 per cent.

Lütke method.
11 results stood between 1.35–1.39 per cent.
1 result was 1.48 "

That the simpler technic of the Lütke procedure was an advantage might be concluded from the less variation in those results, yet the number of determinations made was fewer.

Phosphates.—The volumetric determination of phosphoric

acid is another determination in which the clinical chemist finds pleasure and satisfaction.

The method used is described best in Neubauer and Vogel, i. e. to 50 ccs. of urine are added 5 ccs. of a solution of sodium acetate 100 gms., glacial acetic acid, 30 grms. in 1 liter of water. The urine was then kept at boiling point and the standard solution of uranium nitrate added till the end reaction is reached.

Two indicators were used, cochineal, a very pretty indicator and much the easier to use, and potassium ferrocyanide, the indicator more generally used and perhaps with fewer objections. One thing must be borne in mind: these indicators do not indicate the same reaction, and that one must be used which was employed to standardize the uranium nitrate solution, or gross error will arise. In the following table one urine was studied, both indicators used, and but one uranium solution which had been standardized with cochineal as indicator. The amounts given are grams of P_2O_5 in 1 liter of urine.

Urine I.

Cochineal as indicator.

3 results stood between 1.65–1.69 gms.
33 " " " 1.70–1.77 "
of these 18 " " " 1.72–1.73 "
Difference between extremes 1.73—1.65=.08 gms.

Urine II.

Potassium ferrocyanide as indicator.

10 results stood between 1.82–1.89 gms.
9 " " " 1.90–1.99 "
5 " " " 2.00–2.08 "
Difference between extremes 2.08—1.82=.26 gms.

Cochineal as indicator.

5 results stood between 1.73–1.79 gms.
18 " " " 1.80–1.85 "
2 " " " 1.87–1.94 "
Difference between extremes 1.94—1.73=0.21 gms.

This latter was the Class's first attempt at this determination. The difference in the indicators is well seen. The cochineal is not only easier to use but the students agreed much better in their results. That these two indicators do not show the same end reaction, is well shown. Yet the success of cochineal as a good indicator in urinary examination must not lead one to conclude that this method can be used to determine phosphoric acid in other fluids.

Sugar.—In the case of some necessary determinations the practitioner is satisfied with approximate results, some determinations being made because of their scientific interest rather than practical importance; but the determination of sugar in the urine is of great importance to the patient, and unless done accurately it has little or no value. The physician will govern the treatment and diet of a case according to the difference in amount of sugar after certain experiments with the diet; but what is of greater importance, although probably still out of the reach of the practitioner, the difference between the amount of sugar as shown by titration and that by the polariscope is an excellent method, perhaps the best, of judging the amount of oxybutyric acid in the urine; and the need of accurate determination of the degree of acidosis must become clearer and clearer as the importance of the condition is better understood.

Unfortunately the titration of sugar by means of Fehling's solution is not easy, but requires considerable training and is perhaps the hardest determination to do well that the clinical chemist will make. Also it is a rather long process, at least one-half an hour being necessary.

Several modifications of Fehling's method have been proposed, which seem to simplify matters so far as time is concerned. These may be convenient for a person to use who is skilled in the old method, but do not seem intended for the beginner. Here, we believe in training the student in the Fehling method, and when he understands that thoroughly and can apply it accurately, he may safely attempt some shorter method, but one in which the chance for error is perhaps greater.

Accuracy in this method means attention to details, a proper dilution of the urine, and, strange it should need such emphasis, thorough mixture of the urine with the water used to dilute it; the proper arrangement of the apparatus that work may be rapid and not too hot; the proper position of the flask after adding the urine and boiling, that the "clear line" below the meniscus may be well seen (this means a white, light background); and lastly, the practice necessary to find this line and adjudge its color.

This determination is so important that the class practiced it considerably. The result of the determinations made of one urine are given.

3 results stood between 4.42–4.49 per cent. glucose.
16 " " " 4.50–4.59 " "
5 " " " 4.60–4.69 " "
5 " " " 4.70–4.76 " "
2 " " " 4.80–4.81 " "
Difference between extremes 4.81—4.42=0.39 per cent.

These figures will show that with attention to detail and some practice, the determinations are very satisfactory indeed.

Albumin.—The accurate determination of albumin is much desired by the practitioner, and with good reason, yet it would seem that this is as much out of his reach now as formerly. Even the clinical chemist finds it hard to do well, for the only good way is to coagulate the albumin so thoroughly that the filtrate gives no test, dry in a thermostat the precipitate on a weighed paper and then weigh both together. This seems simple, but it requires a thermostat, an accurate analytical balance, and much time, for the person when he begins to make the determination does not know whether the coagulation alone will consume five minutes or one hour, so difficult it sometimes is to get just the right acidity. Many approximate methods have been proposed and used: the Esbach albuminometer, the centrifuge, the determination of specific gravity or nitrogen before and after removing the albumin, refraction, polarization and various optical methods, et al., while others prefer to esti-

mate from the appearance of the nitric acid coagulum (see Ogden, Clinical Examination of the Urine).

Esbach's Albuminometer is an instrument in quite general use. It is one which, if used according to certain directions (all of which do not accompany it), would give fair results, but in the way it is used gives for the most part results which cannot satisfy a person desiring even merely approximate ones. Some of these points important in its use are that the specific gravity of the urine should by dilution be between 1006 and 1008; that the amount of albumin should (by dilution) be not above 4 per m. (0. 4 per cent); but what is of prime importance, the temperature of the room in which the tube stands for twenty-four hours should vary little from 15° C. This last is a requirement which the practitioner cannot fulfill, and yet its importance is the greatest. Christensen (Virchow's Arch., Bd. 115, 1889) found that in some urines a difference in temperature of 5° C. could cause a difference in readings of 100 per cent. If such an error is possible the instrument is almost useless as a quantitative instrument. We have used the instrument considerably and give a few illustrations of the results as compared with results obtained gravimetrically, and those with the Purdy centrifuge. In a building in which the temperature in some rooms remains fairly constant, the instrument may be of good service, but unless this is the case it could hardly be relied upon to determine whether albumin was rising or falling. One can, of course, by means of it tell whether albumin is less than 1 per m. or between 1 and 3, 3 and 5, 5 and 7 per m., etc., but that errors are considerable is well seen by consulting the above-mentioned article of Christensen. The results we give are a very few examples of a long series of parallel determinations. So many such trials of the instrument have been published and since scarcely one text-book of clinical chemistry gives the instrument more than faint praise, more tables are not necessary. These parallel tests were made, not under the conditions at which the instrument would give its best results, but purposely under those conditions under which the practitioner is forced to use it. Hence the urine is in all cases acidified and diluted, but not placed in a room of constant temperature, although the temperature did not vary much.

The *Centrifuge Method* has been resorted to for many determinations, and among these of albumin. The method is variously applied, but perhaps best by Purdy, whose latest modification is found in the fifth edition of his book. He lays great stress on the necessity of diluting the urine till the percentage of albumin shall be less than 0.2 per cent by weight; (10 vol. per cent) on the length of the arm of the centrifuge, and on the speed used. When one considers the effect which a difference of half an inch in radius of rotation of the column of urine, and the influence which the change of a few hundred revolutions per minute have on the force which packs the precipitate into the point of the tube, he can easily see the need of following Purdy's directions to the letter if he wishes to use this author's tables for calculating his results. I determined to follow all these directions carefully. Purdy's centrifuges are in great variety on the market and finely graduated tubes are in as many various lengths (they are graduated for volume, and this was accurately done in all I tested). To fulfill Purdy's specifications a new centrifuge arm had to be made to order, that the distance from the center of rotation to the tip of the tube should be just $6\frac{3}{4}$ inches. A good speed indicator was used at each determination that a speed of just about 1500 revolutions could be depended upon. This is an important point, since the electric current did vary at different times of the day, and a difference in speed in either direction is important. The instrument was stopped just at three minutes, and the reading made. Under these conditions the precipitate is by no means of the minimum volume, but only under these conditions could Purdy's tables of relation between volume and weight per cent be used.

The figures in the following table are all "weight per cent" (i. e., 0.2598 per cent = 2.598 per m.).

	Gravimetric.	Esbach.	Centrifuge.
I.	0.2908	0.28	0.229
	0.2984	....	0.292
II.	1.1592	0.68	1.252
	1.1454	....	1.416
III.	0.7280	0.42	0.688
	0.7260	....	0.646
IV.	0.2884	0.2	0.292
	0.2834	....	0.271
V.	0.4900	0.27	0.390
	0.4806	....	0.422
VI.	0.3458	0.49	....
	0.3489	....	....
VII.	0.2055	0.17	....
VIII.	0.3314	0.26	....
IX.	0.5624	0.18	0.354
	.....	....	0.374
X.	0.2836	0.26	0.250
	0.2848	....	0.292
XI.	0.3030	0.15	....
	0.3096	....	....
XII.	0.8976	0.50	....
	0.8824	....	....
XIII.	0.3128	0.2	....
XIV.	0.6148	0.3	....
	0.6066	....	....
XV.	0.6194	0.4	....
	0.6124	....	....

From these figures it will be seen that neither of these methods is a very satisfactory way of estimating albumin. Accurate results are sometimes obtained, often with the centrifuge, but not so labelled that they may be recognized.

Urea by the Doremus Tube.—This little piece of apparatus is so much used and the advantages, especially of its various modifications, so well recognized that a few words on its use may not be out of place. Our medical students practice with the simple Doremus tube, although the Hinds' modification is much better. But we shall not speak of the students' use of the method, but of the nurses', for we hope the time is not far distant when the urea chart will be the duty of the trained nurse as well as the temperature chart; for the suc-

cessful use of the urea tube depends on skillful manipulation rather than scientific training, and a nurse can be trained to make the determination as satisfactorily as can the doctor.

The Intermediate Class of the Nurses Training School connected with the Johns Hopkins Hospital is given a course in urinary analysis, consisting of lectures and laboratory work. They meet on six days, one hour a day, and are trained to make the following tests: Specific gravity; the presence of albumin (heat and Heller's tests), its amount as measured by the Esbach tube; the presence of sugar (Fehling's test) and the determination of urea with the Doremus tube. After this course they have a practical examination, testing various urines.

The following are the results of the urea determinations made at this year's final examination. The question was: "How many grains of urea per 1 l.?"

11	students	obtained	the	same	result	as	the	instructor.
8	"	"		results	1	grams	lower	than instructor.
2	"	"	"	2	"	"	"	"
3	"	"	"	1	"	higher	"	"

Had we been able to provide them with the Hinds' modification I imagine their results would have been even more uniform, yet those who have used the apparatus with its 1 cc. pipette cannot fail to appreciate the uniformity of the above figures. I would also add that not one of the twenty-four nurses was in error concerning the presence or absence of sugar and albumin.

Again we wish to repeat; these reports of class work are given not as models of accuracy—we certainly would not claim that—but in hopes that some of the many interested in clinical chemistry, yet who have not had the advantage of good training in pure chemistry, may have a clearer idea of what accuracy they may expect to attain should they wish to use any of the above methods. Our advice to such a person would be to work in clinical chemistry as much as he is able, for he will be more than amply repaid thereby, but to waste no time with a questionable method; and having first chosen a line of work, practice his method on artificial solutions of known composition, then by controlling his work by parallel determinations, not made under exactly the same conditions, be sure his method has been rightly applied to the fluid in question.

ALBUMINOUS EXPECTORATION FOLLOWING THORACENTESIS, WITH REPORT OF A CASE.

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(*From the Clinic of Professor Osler.*)

Albuminous or serous expectoration following thoracentesis is one of the rarest events in pleural effusion. The first author to mention the subject was Pinault, who in 1853 reported two cases. In 1873 Terillon[1] collected twenty-one cases. Following the appearance of his monograph the subject received for nearly two years a very animated discussion in the French journals and several additional observations were reported. West[2] in 1896 estimated that the total number of recorded cases was probably under fifty; while Ortner[3] in 1899 thought that the total number of cases in the literature at the greatest was only about thirty. This latter figure is probably too low an estimate.

Ewald[4] states the phenomenon to have occurred in his practice in one out of twenty-six; Martineau in one out of fifty cases of thoracentesis, but these figures give an erroneous idea of its frequency. West has seen but one instance out of a very large number of cases and his experience agrees with that of other clinicians of large experience.

[1] Terillon, De l'expectoration albumineuse après la thoracentese, Paris, 1873.

[2] West, Transactions of the Clinical Society of London, 1896, vol. xxix, p. 169.

[3] Ortner, Wiener klinische Wochenschrift, 1899, p. 1090.

[4] Ewald, Cf. ref. in Wilson Fox—Diseases of Lungs and Pleura, p. 1070.

Among the records of The Johns Hopkins Hospital I have been able to find but one instance of the affection.

M. J. L., æt. 25, admitted to Professor Osler's ward May 15, 1901, complaining of pain in his stomach.

Family history was good; no tuberculous history.

Personal History.—The patient had always been very healthy. He had had none of the ordinary diseases of childhood except measles. He remembered no other acute illness. He denied venereal contagion; indulged only moderately in alcohol. Six weeks previous to admission he had an attack of sharp pain under the lower border of the ribs on the left side; this he thought had been caused by straining. He was easily relieved by internal medication.

Present Illness.—Nine days previous to admission he became overheated while on a long bicycle ride. In the evening he was seized with a sharp sticking pain under the lower left ribs; this was much exaggerated on taking a deep breath; it was relieved by pressure. There was no chill; patient does not think he had fever. He was able to continue at his work but felt badly, lost his appetite and complained of some shortness of breath. He occasionally had a slight cough but no expectoration.

Physical examination on admission showed a well-nourished, healthy looking man; mucous membranes of good

color; the tongue clean. The patient was not suffering from dyspnœa; the respirations were thirty-two to the minute. The pulse was one hundred; of rather small volume and low tension.

Examination of the thorax revealed slight prominence of the left upper front with obliteration of the interspaces in the left axillary region. The expansion of the entire left side was diminished. Tactile fremitus was absent throughout the lower left axillary and subscapular regions. The percussion note was impaired and of Skodaic quality in the first left interspace. In erect posture flatness began at the level of the second rib; in recumbent posture at the level of the second interspace. The percussion note was flat throughout the axillary region and over the entire left back as high as the level of the spine of the scapula. On auscultation a few moist râles were heard over the left clavicle and the left supraspinous fossa. Over the area of flatness the breath sounds were very distant.

The right lung was practically negative; a few moist râles were heard at the extreme base.

Heart.—Cardiac impulse was seen in the third and fourth right interspaces almost to the nipple line. Relative dulness extended to a point eight centimeters from the median line in the fourth right interspace; absolute dulness to a point five centimeters from the median line in the same interspace. The heart sounds were clear.

The remainder of the physical examination was negative.

Owing to the extent of the effusion it was deemed best to aspirate and accordingly, on May 16, a needle was inserted in the eighth interspace in the posterior axillary line. After 320 cc. of turbid, yellow fluid had been withdrawn the flow suddenly ceased and no more fluid could be obtained from that situation. The patient experienced no unpleasant after effects.

On May 20 a needle was again inserted in the left side posteriorly but after withdrawing 730 cc. of turbid fluid the aspirating apparatus began to leak and the tapping had to be abandoned. Again the patient experienced no unpleasant symptoms.

On May 23 a third attempt was made and this time 3100 cc. of fluid were withdrawn. The aspiration was done slowly and three interruptions were necessary in order to change receiving bottles. Towards the close of the operation the patient began to complain of slight shortness of breath and of a smothering sensation. After about half an hour there began a series of severe paroxysms of coughing, each being followed by profuse expectoration of serous, frothy sputum. The paroxysms followed each other at very short intervals and the patient complained much of dyspnœa. After lasting about one hour the symptoms gradually subsided but the patent continued to expectorate for two or three hours longer.

The total amount of expectoration was not accurately measured but approximated one liter. It was very frothy, of a pale green color, translucent, and on standing deposited a muddy sediment. Treated with nitric acid it gave an abundant precipitate of albumin. Examined microscopically it contained large numbers of bacteria; many flat epithelial cells; a few red blood-corpuscles and some polynuclear leucocytes.

A differential count of the leucocytes in the effusion showed: polymorphonuclear leucocytes, 1.7 per cent; large mononuclear leucocytes, 1.9 per cent; small mononuclear leucocytes, 96.4 per cent. No tubercle bacilli could be found in a centrifugalized specimen.

The subsequent history of the patient was satisfactory; the effusion did not reaccumulate and he was discharged June 12, 1901.

Terillon divides the cases of albuminous expectoration into three classes:

I. *Mild Form.*—The expectoration may come on immediately at the close of the thoracentesis; usually a short interval elapses. The patient after being rendered more comfortable by the removal of the effusion, commences to cough and to complain of some shortness of breath and soon to expectorate a considerable quantity of clear, frothy fluid. It is expectorated at times without intermission and accompanied by almost constant cough. After lasting for a variable length of time, the symptoms gradually subside. In this form the general condition of the patient is always good and never excites alarm. The quantity of the expectoration varies from a few grams to 800 grams.

II. *Severe Form.*—This differs from the preceding in the intensity of the dyspnœa, the abundance and persistence of the expectoration and the severity of the cough. The onset is usually abrupt and the sense of oppression extreme. The symptoms rapidly reach their maximum intensity. The dyspnœa may be excessive and accompanied by a sensation of great anxiety. The patient shows signs of collapse and asphyxia; the face becomes cyanotic and the skin is covered with a cold, clammy perspiration. The symptoms may last several hours or an entire day but with varying intensity. The quantity of expectoration in this form varies between 1200 and 1500 grams.

III. *Grave Form.*—In this form the onset is sudden; the patient is suddenly seized with extreme dyspnœa and expectorates a large amount of frothy fluid; the symptoms grow rapidly worse, fluid gushes from the mouth and nose and the patient quickly dies of suffocation. In this form death may be very rapid, in some cases in less than fifteen minutes after the onset. Sometimes in fact the gravity of the accident is such that there is no time for the expectoration to appear. The patient succumbs to asphyxia and post-mortem the lung is found œdematous and the bronchi filled with fluid.

In all three forms the character of the expectoration is the same. The fluid is frothy; more or less viscid; of a slightly yellowish or greenish color. On standing it separates into three layers; the upper frothy and clear or slightly yellow in color; the middle clear or slightly cloudy according as the expectoration is abundant or small in amount; the lower denser and forming a granular deposit containing cellular elements. Occasionally slight traces of blood are

present. Tested with heat and with nitric acid the fluid yields an abundant precipitate of albumin. Acetic acid precipitates a varying quantity of mucin. Microscopical examination reveals large numbers of bacteria; cellular elements from the respiratory mucous membranes; some polynuclear leucocytes and occasionally red blood cells.

Onset.—Occasionally the expectoration begins before the tapping is completed or immediately after it. More commonly, however, an interval varying from five minutes to one or two hours elapses before the symptoms set in. Pepper [5] states that in the only case observed by him the interval was eighteen hours. In the majority of cases it is less than one hour.

Duration.—This is variable. The attack may last only a few minutes; more commonly an hour or two; occasionally as long as one or even two days. In general the duration varies directly with the quantity of expectoration, but in a case of short duration the sputum may be very abundant.

The quantity of fluid expectorated is extremely variable; usually from 200 to 700 grams; sometimes as much as two liters.

Auscultation of the lung on the affected side reveals everywhere loud bubbling râles with fine crackles at the base; signs of an œdema of the lung. Râles may also be present on the unaffected side.

Serous expectoration is not necessarily associated with the use of suction in the removal of the effusion, for it has occurred in a number of instances where the fluid was removed by siphonage. In fact, it is stated to occur occasionally in pleural effusion before paracentesis has been performed.

In a few instances albuminous expectoration has followed several tappings on the same patient. Behier records a case in which this happened four times and on both sides of the thorax. Gee [6] reports a case in which it occurred three times in the same patient.

It is an interesting and instructive fact that in most of the cases of albuminous expectoration the amount of fluid removed from the pleural cavity has been large; a liter and a half or over; in three instances as much as five liters. In our own case it was three liters. Rapid withdrawal of the fluid seems also to increase the risk of albuminous expectoration. These facts have led several authors to recommend slow withdrawal of relatively small amounts of effusion; not more than 1200 cc. at one time and not to attempt to drain the pleural cavity at one sitting.

The number of fatal cases of albuminous expectoration is comparatively large; at least a dozen have been recorded. The general post-mortem appearances of the lungs are those of extreme œdema. The albuminous fluid may also be found filling all the bronchi, the trachea, the larynx, the pharynx and even the nasal fossæ. In a number of the fatal cases adherent pericardium has been found. Scriba [7] and Ortner each record a case in which in addition to the other findings a fibrinous plug was present in the bronchi of the affected lung.

Four main theories have been advanced to explain the phenomenon of albuminous expectoration:

1. Perforation of the lung by the trocar.
2. Spontaneous perforation of the lung.
3. Reabsorption of the fluid remaining after thoracentesis.
4. Acute œdema of the lung.

1. Perforation of the lung by the trocar and discharge of the pleural fluid through the lung. The supporters of this theory lay especial stress on the similarity between the expectoration and the pleural fluid. But though having considerable resemblance to one another, in many cases they are quite different; the pleural fluid is often hemorrhagic while it is the exception for blood to occur in the expectoration. Prodhomme [8] relates a case in which 2000 cc. of pus were aspirated from the pleural cavity followed by characteristic albuminous expectoration. Other objections to this theory are that (a) no perforation of the lung has ever been found post-mortem; (b) the danger of wounding the lung in tapping a large effusion is practically nil; (c) finally, if due to a perforation, the expectoration should begin at once and not, as is usually the case, after an interval.

2. Spontaneous perforation of the lung. Although spontaneous perforation of the lung in serous effusion does occasionally occur it is an exceedingly rare event; much less common than in empyema. If the fluid escaped through a perforation, pneumothorax should result and all are agreed that this is very unusual. Finally the quantity of expectorated fluid is often much larger than can be accounted for by this theory.

3. Reabsorption of the fluid remaining after thoracentesis and its discharge through the pulmonary vesicles and bronchi. The chief argument against this view is that it is contrary to the teachings of physiology. The natural pathway for the absorbed fluid would be into the lymphatics and thence into the general circulation, and however rapid this process might be it would not be accompanied by exudation into the bronchi. Furthermore in pleurisy with thickening of the membranes the absorptive power is greatly reduced.

4. Acute œdema of the lung. This is the view that was advanced by Pinault in 1853, who described the first cases, and is the one that is accepted to-day by most observers. The physical signs observed during life as well as the post-mortem findings support it. The exact mechanism by which the œdema is produced is still an unsettled matter. Johnson [9] thinks that while the lung is compressed by the effusion and its circulation is sluggish, coagula form in the minute vessels, especially the veins. As the effusion is removed the amount of blood flowing to the lung is increased,

[5] Pepper, Philadelphia Medical Times, 1873–74, vol. iv, p. 718.

[6] Gee, St. Bartholomew's Hospital Reports, London, 1886, vol. xxii, p. 99.

[7] Scriba, Deutsches Archiv für klinische Medicin, vol. xxxvi, 1884–5, p. 328.

[8] Prodhomme, De l'expectoration albumineuse, Paris, 1874.

[9] Johnson, British Medical Journal, 1873, vol. ii, p. 479.

but owing to the obstruction offered by the coagula in the veins there results a passive engorgement of the capillaries and a consequent transudation of serous fluid into the air cells.

Duffin [10] disagrees with Johnson and thinks the œdema is to be explained by the temporary damage done to the vasomotor nerves by compression; when this is removed the vessels dilate and remain so until the nerves recover sufficiently to cause contraction of the vessels.

Cohnheim has shown that the permeability of the vessels in a lung which has been for some time compressed is considerably greater than that of a healthy lung. Most observers would explain the œdema by reason of this abnormal permeability and the rapid engorgement of the lung which follows the withdrawal of the pleural effusion.

But though this seems reasonable it yet remains to be explained why albuminous expectoration does not follow every thoracentesis inasmuch as these favorable conditions are present in every case.

Probably the explanation is to be sought in the abnormal pathological conditions which are so commonly found in the fatal cases, such as cardiac insufficiency; adherent pericardium; clots in the pulmonary vessels, etc. Ortner, in a study of twelve fatal cases, finds in at least eleven the common factor of difficult mobility or complete immobility of the mediastinum, the result of adhesions to the lungs, the sternum or the pericardium. He concludes that the œdema has for its immediate cause an abnormal permeability of the blood vessels of the compressed lung, aided frequently by cardiac insufficiency. The sudden emptying of the pulmonary vessels causes increased flow of blood to the left heart; this is unprepared for the extra exertion and there results a disproportion in work between the right and left heart and consequently lung œdema. This œdema is the more easily produced when, owing to adhesions, the mediastinum is prevented from assuming its normal position as the effusion is drawn off.

The exact mechanism by which the lung œdema is produced must still be left an unsettled question. West hints that a careful study of the lymphatics in these cases might aid in a solution of the problem.

[10] Duffin, British Medical Journal, 1874, vol. i, p. 372.

NOTE.—Since this article was written two cases of albuminous expectoration following thoracentesis have been reported from this country. The first by Riesman appeared in The American Journal of the Medical Sciences for April, 1902, p. 620. A full bibliography accompanies the article. The second by Patek appeared in American Medicine for August 23, 1902, p. 287. Subsequent reports may show that this phenomenon is possibly not as uncommon as is generally supposed.

A STUDY OF THE RETICULAR SUPPORTING NETWORK IN MALIGNANT NEOPLASMS.

AS STAINED BY MALLORY'S METHOD.

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Observations on the presence of several varieties of connective tissue in tumors have been recorded in well-known papers. Comparisons have been drawn between the distribution of the connective tissue in the sarcomata and carcinomata, but I believe that heretofore there has been no thorough comparative study of the finer supporting organization of all the types of malignant tumors—by which I mean, carcinomata, sarcomata and endotheliomata, which last type includes the peritheliomata.[1]

That such a study would be generally interesting was a foregone conclusion, but there was a possibility that it might be very useful in assisting to make diagnoses of the more obscure growths by a fairly rapid method and also establish the relations between the various types of new growths.

Mallory's method was chosen because fresh tissue is not always to be had and because I had found that the use of digestion methods was unsatisfactory in fixed specimens. This method is, beside, a particularly brilliant method of staining, for, not only the supporting tissues, but, in well-fixed specimens, the cells are clearly and brightly stained, allowing a more careful study of the relation of framework and cellular elements.

In using the method I have made a slight modification which I think brings out the colors somewhat better than the original method. This deviation is simply in the use of a drop of aniline oil on the section just after the alcohol, but the method I will give in detail.

Sections are cut from tissue hardened in Zenker's fluid and imbedded, preferably, in paraffin. These are fixed on slides in the usual way and then the paraffin is dissolved off and the slide immersed in absolute alcohol, 95 per cent alcohol, 70 per cent alcohol, then in water. They are then stained in a 1/10th per cent aqueous acid fuchsin solution for from 2-3 minutes, then washed in water; a few drops of a 1 per cent solution of phospho-molybdic acid is then dropped on the section and allowed to remain for about 5-7 minutes. The slides are now carefully washed in water and

[1] On the subject of endotheliomata and their intercellular substances I can find but a few isolated remarks, such as the one quoted from Johnston, and the one quoted from Israel's paper (Berl. klin. Woch., 1900) by Lubarsch and Ostertag (Ergebnisse, 1901), in which it is stated that endotheliomata do not lose their ability to form an intercellular substance under all circumstances, a morphological characteristic which differentiates them from the epithelial tumors.

the stain composed of aniline-blue 0.5 grams, orange G, 0.2 grams and oxalic acid 2 grams, with 100 cc. of water, is dropped on, to remain for about twenty minutes. The slides are then rinsed in water, hurriedly dehydrated with 95 per cent alcohol and then a drop or two of aniline oil is allowed to remain on until the sections are clear, when it is removed by blotting and the sections are then cleared in xylol and mounted in balsam.

By this method the finest reticular processes can be seen clearly and distinctly, and their relation to the cells studied with any power of the microscope.

Before speaking of the structure of the tumors I think it will be well to recount the structure of the tissues in which the growths arise. In doing this I can let the paper of Dr. Adami on classification speak for me, in part, for in this communication the author reviews the genesis and structure of the body layers in an extremely clear manner.

Briefly then—At an early stage of the life of the embryo there are three layers of cells developed from the one original layer; these are, epiderm, hypoderm, and mesoderm. But at a somewhat later time the mesoderm "from being a simple undifferentiated cell mass, which we may compare with the morula, certain of its cells growing outwards between the epiblast and hypoblast, become arranged into a definite layer to form or enclose the primitive body cavity. From this point onwards we can distinguish two structures of mesoblastic origin—the mesothelium, or lining-membrane portion of the mesoblast; and the mesenchyme or the mesoblastic pulp." So, as Adami says, "during embryonic life one obtains a series of differentiations of the primitive cell layers leading to the production of two sets of tissues; one which we may term the *lining-membrane tissues*, the other, the pulp tissues" (p. 5). Both of these layers become developed widely, and highly differentiated, into organs and tissues, but "even in cases where there is the widest divergence from the original type of lining membrane, we find that this distinction still holds, that the parenchymatous cells form *layers or groups of cells into which the vessels do not penetrate, and in which there is an absence of stroma between the members of the cell groups*. While, contrariwise, regarding tissues originating from the embryonic pulp, we notice that in them the prominent characteristic is that there is an *intercellular ground substance, either homogeneous or fibrillated, separating the specific cells of the tissues*" (p. 6).

It is because of such features as these that Adami speaks of tumors arising from the lining membranes of the body as lepidomata (lining membrane tumors) and hylomata (pulp tissue tumors).

The object of this paper will be to show how closely the tumors adhere to the types of tissue in which they originate —judged by the arrangement and distribution of their intercellular substance.

First of all—if, "after the embryonic period hylic tissues never take on lepidic characters," we would expect to find among the tumors that none of those arising in connective tissue of any kind would present any of the features of a carcinoma.

Second, we might expect the reverse to be true if we confine ourselves to tumors arising in mature epithelium or hypothelium.

Judging from the case reports of several writers we cannot expect the tumors arising in mesothelial tissues to possess such stable characters, and since the endothelium is a later development from a relatively undifferentiated tissue, we should expect this lining membrane to show no more permanent characters than those of the physiologically functional cells derived from mesothelium, and too, less stability than has the older hypoderm or epiderm. In view of such peculiarities of the tumors arising in these differentiated mesodermic tissues, Adami calls them the "transitional lepidomata."

When we come to study the finer supporting tissues of the class of tumors which are more usefully—for the present purpose—called lepidomata, since this term excludes those growths which may originate in other than the true covering

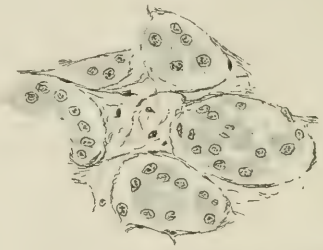


Fig. 1. Cancer of rectum. Metastasis in lymph gland. Mallory's stain. Leitz, I–6.

membranes, we are able to state definitely that the rule is for the absence of an intercellular fibrous tissue. This point White has made after a careful study of tumors, treating them by Mall's, Spalteholz', Van Gieson's, Weigert's and Mallory's methods. The text of his conclusion is as follows: "Carcinomata possess a stroma of white fibrous tissue outlining the cell spaces, but have no intercellular network" (p. 220).

Petersen (Verh. d. deutsch. path. Gesell., 3 Tag., 1901, 61) has offered the same conclusions.

In order to be convinced and see for myself that this is true I have made Mallory preparations from a number of carcinomata of rectum, gall duct, stomach, metastases in lymph glands and adrenal, and in other organs, and have been able to reach the same conclusions, with the slight apparent variation due to the observation that in a rapidly infiltrating cancer, for instance of the stomach, when single cells are more or less isolated at the margin of the growth, the appearance may lead one to think that there is an intercellular reticulum. But if even the smaller aggregations of cells are studied it will be found that in no case is there a definite intercellular supporting network (Figs. 1 and 2).

About the cell groups in carcinomata the fibrous tissue forms a perfectly definite boundary zone with no tendency for the fibrils to branch into the cell groups.

When we come to study the sarcomata (hylomata) in the same way, we see that in rapidly growing nodules, while the reticulum is not always invariably present in the centers, that the surrounding fibrous tissue is not well defined and definite and that fibrils are dipping down into the cell masses, and that between the cells in various parts of the nodules short intercellular fibers can be seen. In gradually growing nodules the intercellular tissue will be seen complete, justifying completely White's conclusion that "Sarcomata present a larger increase in the connective tissue and possess an exceedingly fine intercellular reticular network, very similar in structure to the reticulum present in normal glandular tissue."



FIG. 2. Cancer of breast. Metastasis in lymph gland. Mallory's stain. Leitz, I–6.

Johnston also makes definite statements as follows: that there is a "reticulum present to a greater or less degree in every sarcoma," and that "the reticulum is entirely absent between the cells of carcinoma and endothelioma, a valuable differential point." The last part of this conclusion we will discuss presently.

Polak comes to the same conclusion with reference to the sarcomata.

I have been able to justify these conclusions after a study of several sarcoma, of stomach and mediastinal glands.

Now when we come to examine the structure of the endotheliomata (secondary or transitional lepidomata), we have to deal with a group of tumors that arise from cells differentiated from the middle germinal layer and from the mesothelium. Consequently they are embryo-genetically more closely related to the sarcomata than to the carcinomata (using the terms in their morphological sense). But with this origin and relationship they bear, nevertheless, in a great many instances, a very close morphological resemblance to the carcinomata.

As they are usually described, they form two more or less well-marked types, according to their origin in the lining endothelium of blood vessels, or in that surrounding the blood vessels, which is generally supposed to be the endothelium lining the perivascular lymph spaces.

For my study I have had a very large number of excellent specimens, about forty in all, and for the majority of these I am greatly indebted to Dr. Hektoen of the University of Chicago, and to Dr. Henry Christian of the Boston City Hospital. My method of preparing sections I have described.



FIG. 3. Endothelioma. Mallory's stain. Leitz, I–6.

So far I have been able to find no general difference in the distribution of the reticular meshwork in the endotheliomata and peritheliomata. The only difference occurs in the very cellular, well circumscribed, and the infiltrating forms.

When the cells of the tumor growths are arranged in groups, more or less as in the carcinoma simplex, the general rule has been that these cell masses are surrounded by a well-marked fibrous tissue and with very rare intercellular fibers, but there is this difference from carcinomata, that *there is a tendency to the formation of an intercellular reticulum* which is, in some cases, only shown by filaments from the enveloping fibrous tissue dipping down into the cell masses, and in many cases branching and surrounding a few of the peripheral cells. In sections of the same tumors in which this is seen there may also be groups of cells in which the process has gone farther, and *between the majority of the cells in the group there is a definite intercellular meshwork.* This

is apparently regardless of the endovascular or perivascular origin of the growth (Fig. 3).

We see here very plainly evidence of the relationship between the endotheliomata and the sarcomata. This similarity is still more markedly shown in the infiltrating growths in which, while about the vessels the reticulum is scarce, the cells are separated by a well-marked reticulum and has all the appearance of a sarcoma.

I am convinced that this appearance is not due to the presence of the reticulum of the normal tissue into which the cells have penetrated, because the arrangement is too definite and general, and is entirely unlike the picture presented by the infiltrating carcinomata, when a few cells may be seen surrounded by the blue-stained fibrils. In cancers there are few examples in a specimen of a regular intercellular formation, and these few examples would be no more than we might expect, simply as an artefact, due to the cutting through the end of column of cells, the whole surrounded by a reticulum.

The conclusions that I have drawn are that the alveolar endotheliomata show, at the least, a partially-formed intercellular reticular network; at the most, an almost complete one; and that the infiltrating forms show a complete meshwork which corresponds to that of the sarcomata; that all endotheliomata of whatever origin show a tendency to a sarcomatous structure as regards the relation between cells and reticulum.

The application of this, in at least one way, is obvious. It represents most graphically the peculiarities of the derivation of the middle germ layer in its instability compared with the cells of the other layers, and brings out quite prominently the tendency of such relatively unstable tissue to revert to the simple embryonic type, to lose its acquired functions and retain its hereditary one of simple growth, and in that growth to preserve all the peculiarities of the great group of connective tissues to which it really belongs.

This study shows also, I think, the value of the embryological basis of the classification of tumors.

As a final word, but really as a statement of a preliminary thought, I thank Dr. Adami for his untiring interest in my work.

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NOTES ON NEW BOOKS.

An Introduction to Physiology. By WILLIAM TOWNSEND PORTER, M. D., Associate Professor of Physiology in the Harvard Medical School. Part IV—Physiological Optics. (*Cambridge, Mass.: The University Press, 1902.*)

A note of a preceding portion of Porter's Introduction to Physiology has already appeared in a former BULLETIN. This little primer of 93 pages contains much clear information and seems especially adapted to the use of students who are compelled to teach themselves with simple apparatus at home. A student who had personally conducted the series of experiments set down in this book would unquestionably enter upon the further laboratory study of the physiology of optics with a clearness of perception which would be most helpful.

The Principles of Bacteriology: A practical manual for Students and Physicians. By A. C. ABBOTT, M. D., Professor of Hygiene and Bacteriology and Director of the Laboratory of Hygiene, University of Pennsylvania. Sixth edition, enlarged and thoroughly revised, with 111 illustrations of which 26 are colored. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

The value of this book is well attested by the appearance of a sixth edition within ten years. It is probably the best manual we have for the class room and the prompt revision which it receives renders it modern and full of interest to the student. The first thirteen chapters furnish full and detailed instruction as to bacteria, their mode of multiplication and spore-formation, the principles of sterilization, methods for the isolation and cultivation of bacteria, methods of staining bacteria and finally their behavior when introduced into the animal body. The latter half of the work treats of the application of the methods of bacteriology to the study of disease and gives a description of special pathogenic organisms. We are gratified to see that the newer work in dysentery receives ample notice and that justice is done to the work of Shiga, Flexner and others. The book is practical and modern and deserves the success which it has attained.

Medical Lectures and Aphorisms. By SAMUEL GEE, M. D. (*Smith, Elder & Company, London, 1902.*)

This little book, containing fourteen medical lectures and two hundred and seventy-one aphorisms by Dr. Gee, must be of great interest to his students, since the collection doubtless contains those most characteristic of this eminent physician. Others will find the chapters, although few, brief, and disconnected, very suggestive and interesting.

Practical Dietetics. With Special Reference to Diet in Disease. Second edition. By W. GILMAN THOMPSON, M. D. (*D. Appleton & Company, New York, 1902.*)

This is a much-needed book and well fulfills the object for which it was intended. It is doubtless true that few physicians consider much the chemistry or the physiology involved in the nourishment of a patient by a given diet, much less the mathematics; yet these are quite as worthy of attention as are the chemistry, physiology, and knowledge of doses involved in writing a prescription.

The book contains a surprising amount and is written in an interesting manner. It discusses thoroughly foods and food preparations, their preparation, administration and physiologi-

cal value. The largest and best part deals with the diet in disease, and it would seem that no disease escaped an exhaustive discussion. The chemical and physiological paragraphs contain doubtless all that is essential, yet it is disappointing that the phraseology of these sciences is not more carefully followed, for the use of popular expressions often leads one to read the sentence again to make sure a popular error has not also been accepted.

The book is an excellent one and heartily to be recommended.

Climates and Baths of Great Britain and Ireland. The Climates of London and of the Central and Northern Portions of England. Together with those of Wales and Ireland. Vol. II. (*Macmillan & Company, London, 1902.*)

This large volume contains reports on the climates of certain districts of England, Wales and Ireland. Of these districts the various watering places or health resorts are described, their geographical, meteorological characteristics, drainage, water supply, etc., being presented. Then are given the Prevalence of Disease, the Frequency of Old Age and Common Causes of Death, and the Therapeutical Effect of the Climate. Each of these and many kindred subjects are discussed at length. The object of the volume is to aid the practitioner in choosing a suitable resort for his patient. The book contains many charts and tables.

A Practical Manual of Insanity. For the Student and General Practitioner. By DANIEL R. BROWER, A. M., M. D., LL. D., Professor of Nervous and Mental Diseases in Rush Medical College, and in the Post-Graduate Medical School, Chicago; and HENRY M. BANNISTER, A. M., M. D., formerly Senior Assistant Physician, Illinois Eastern Hospital for the Insane. 426 pages, with a large number of full-page inserts. Cloth, $3 net. (*Philadelphia and London: W. B. Saunders & Company, 1902.*)

"It is the aim of this work to present to the medical student and the general practitioner the essential aspects of mental disease as they have appeared to the authors. It is hoped that it will be found to give an intelligible, up-to-date statement of the leading facts and one that will be serviceable to those who may not be able to give the time for any more exhaustive study. . . . The work is intended for a handy manual for students; therefore elaborate case records and pathologic details, as well as discussions of speculative and controverted questions, are necessarily omitted. To make it the more practical and useful, certain special features are included, such as the mention of the forms of insanity not usually met with in hospitals for the insane, a comparative table of classification, and a chapter on some of the ethical questions relating to insanity as they may arise in the practice of medicine."

The above statement from the preface disarms much criticism. Viewed from the standpoint of the student and general practitioner the manual of Drs. Brower and Bannister is admirable, and they have fully succeeded in presenting the subject of insanity in a clear and concise manner. The authors have very wisely not restricted themselves to any one classification and have therefore given themselves greater freedom to treat of conditions rather than so-called entities. It is perhaps to be regretted that there should be quite so much brevity in the descriptions of the pathology of certain diseases. It does not seem that any clearness would be sacrificed in giving pathologic details where they are well known and the value of the book would be enhanced to the more advanced student. The description on pages 246-7 of the pathologic anatomy of paresis, while otherwise good in so far as it goes, makes but brief mention of the microscopic changes, omitting any detailed description of the nerve cell or any mention whatever of the disappearance of the tangential fibres. It is presumed that the statement on page 232, that "Its (paresis) period of greatest frequency is in the fourth and fifth decades of life, it is rare after fifty," should read its period of greatest frequency is in the third and fourth decades of life, etc. Lapses such as this are rare, however. The descriptions of insanity are admirable, and especially to be commended is the chapter on "Borderland and Episodic States," where the authors have handled a difficult subject most successfully.

Saunders' Question Compends; Essentials of Diseases of the Ear. By E. B. GLEASON, S. B., M. D., Clinical Professor of Otology, Medico-Chirurgical College, Philadelphia; Surgeon in charge of the Nose, Throat and Ear Department of the Northern Dispensary, Philadelphia, etc. Third edition, thoroughly revised. 16mo volume of 214 pages, with 114 illustrations. Cloth, $1 net. (*Philadelphia and London: W. B. Saunders & Co.; and Baltimore: Medical and Standard Book Co., 3 W. Saratoga St.*)

As a matter of preparing for an examination or to make a hasty review of a subject, these Quiz Compends are very useful to the student. This one covers the subject of otology completely and in a thoroughly satisfactory manner. The most important part of each topic is emphasized by a direct question and the answers bring out in a striking way the modern treatment thereof. The illustrations are apt and aid materially in a clear presentation of the matter.

H. O. R.

Treatise on Diseases of the Skin. For the use of Advanced Students and Practitioners. By HENRY W. STELWAGON, M. D., Ph. D. With 220 illustrations in the text and 26 full-page lithographic and half-tone plates. 8vo, 1115 pp. (*Philadelphia and London: W. B. Saunders & Company, 1902.*)

This is the best complete text-book on dermatology that we have at the present time; it is up to date in all departments and presents many new and valuable features not found in any other work on this subject.

Dr. Wm. M. Welch of the Municipal Hospital, Philadelphia, has written the papers on smallpox, scarlet fever and measles.

The usual chapters on anatomy and physiology of the skin are short but concise and adequate.

Symptomatology is given careful consideration. In order that the student may become well grounded in the rudiments, the primary and secondary lesions of the skin are described in detail. The clinical descriptions of the various diseases are, with a very few exceptions, well written, and the symptoms presented in such a clear and consecutive manner that the student readily grasps the essentials of a disease and easily follows its evolution.

The numerous, well selected and clear photographs aid one in remembering the general appearance of an eruption. Some colored plates have been taken from Mraček Hand Atlas, but they do not compare with the photographs in excellence and it is a question whether they strengthen this feature of the book.

Etiology and Pathology present the various theories and observations of the last 25 years. The views are, necessarily, varied, but will not confuse a careful reader. Numerous illustrations from the drawings of the best workers in this branch of cutaneous medicine enhance the value of this section.

The importance of an accurate diagnosis for the successful treatment of a disease is impressed upon the reader. Many suggestions mentioned in the chapter on General Diagnosis are

simplified and explained in differentiating the various dermatoses and prove of much value. An interesting section under this heading is the one giving Duration, Distribution, Character and Conspicuous Feature of an eruption as a diagnostic factor, although much clearness has been lost on account of lack of space given.

The materia medica and methods of treatment are taken up in detail. The recommendations offered are modern and should prove of value to the practitioner.

A supplementary and well-illustrated section deals with those diseases of adjoining mucous membranes not previously considered.

A most helpful feature to advanced students and dermatologists, and one showing the exacting labor of the author, is the reference bibliography given under each disease.

The British Guiana Medical Annual, Georgetown, Demerara. 8vo, pp. 84 + xxvi. 1902.

While this volume contains no extensive articles, it does contain a number of facts of interest in connection with the subject of tropical medicine. "Filarial lymphangitis" is discussed briefly by G. C. Low, while C. P. Kennard publishes some short "Notes on *Filaria* in birds," and Ozzard gives a "Description of a female parental form of the *Filaria Demarquayi*." Four articles appear on anchylostomiasis or uncinariasis, by Delamare, Ozzard (two articles), and Kennard, the most interesting points being that Delamare reports a blue-black pigmentation of the tongue in 17 cases and considers this an early sign of infection, while Ozzard supports Giles' view that *Uncinaria duodenalis* is subject to a heterogenesis in its development. Ozzard maintains that the free sexual stage develops in 8 to 10 days, and in the free female the eggs are arranged differently from those in *Strongyloides stercoralis*, appearing in one row instead of two; further, the embryo of *Strongyloides stercoralis* develops only in foul water and dies rapidly in decomposing feces, while the rhabditis of *Uncinaria duodenalis* develops best in decomposing feces; again, *Str. stercoralis* comes to maturity in 2 to 3 days, while *Uncinaria* takes at least 8 to 10 days. Ozzard's statements are interesting, but his illustrations are very poor and it is difficult to escape the feeling that his views should be taken with some reserve. It does not appear to be excluded, for instance, that both Giles and Ozzard have been dealing with a rhabditis which is related neither to *Uncinaria* nor to *Strongyloides*.

Daniels and Ozzard publish short papers on malaria, Kennard discusses fever cases, Carter describes three cases of beri-beri, Conyers gives an account of a case of hepatic abscess, de Freitas writes on a case of extrauterine gestation with passage of the fetal remains per rectum, Wishart discusses the influence of rainfall on the death-rate in the tropics, Raleigh has a short paper on anthrax in British Guiana, and the volume ends with The Transactions of the British Guiana Branch of the British Medical Association for the years 1900 and 1901.

Records of the Egyptian Government School of Medicine. Edited by the Director. Pp. 251. (*Cairo: National Printing Department, 1901.*)

Prof. Arthur Looss's article on "The Sclerostomidæ of horses and donkeys in Egypt" is one of the best papers on parasites which has ever been printed, if we view the work from the anatomical standpoint. The illustrations are excellent and, like other work by the same author, they set a high standard which probably few investigators can attain. Like other works by Looss, however, this paper is open to one rather severe criticism, namely, there is no analytical key to the numerous forms discussed. As a result it is necessary to read page after page before one finds just the data desired.

Professor William H. Wilson writes "On the poison of spiders with special reference to that of *Chætopelma olivacea*," concluding that the secretion of the poisonous glands is a viscid fluid of pale yellow color, acid reaction, and hot bitter taste; its physiological effect is apparently similar to curare, causing paralysis of the voluntary muscles, death resulting from the stoppage of the respiratory movements; watery extracts of the glands lose their toxic character upon being subjected to 60° C., and the activity of the venom is destroyed by putrefaction.

Professor Wilson also writes briefly "On the blood of *Chætopelma olivacea* with special reference to the presence of *Hæmocyanin*."

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Read, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND.

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GENERAL STATEMENT.

The Medical Department of the Johns Hopkins University was opened for the instruction of students October, 1893. This School of Medicine is an integral and coördinate part of the Johns Hopkins University, and it also derives great advantages from its close affiliation with the Johns Hopkins Hospital. The required period of study for the degree of Doctor of Medicine is four years. The academic year begins on the first of October and ends the middle of June, with short recesses at Christmas and Easter. Men and women are admitted upon the same terms.

In the methods of instruction especial emphasis is laid upon practical work in the Laboratories and in the Dispensary and Wards of the Hospital. While the aim of the School is primarily to train practitioners of medicine and surgery, it is recognized that the medical art should rest upon a suitable preliminary education and upon thorough training in the medical sciences. The first two years of the course are devoted mainly to practical work, combined with demonstrations, recitations and, when deemed necessary, lectures, in the Laboratories of Anatomy, Physiology, Physiological Chemistry, Pharmacology and Toxicology, Pathology and Bacteriology. During the last two years the student is given abundant opportunity for the personal study of cases of disease, his time being spent largely in the Hospital Wards and Dispensary and in the Clinical Laboratories. Especially advantageous for thorough clinical training are the arrangements by which the students, divided into groups, engage in practical work in the Dispensary, and throughout the fourth year serve as clinical clerks and surgical dressers in the wards of the Hospital.

REQUIREMENTS FOR ADMISSION.

As candidates for the degree of Doctor of Medicine the school receives:

1. Those who have satisfactorily completed the Chemical-Biological course which leads to the A. B. degree in this university.

2. Graduates of approved colleges or scientific schools who can furnish evidence: (a) That they have acquaintance with Latin and a good reading knowledge of French and German; (b) That they have such knowledge of physics, chemistry, and biology as is imparted by the regular minor courses given in these subjects in this university.

The phrase "a minor course," as here employed, means a course that requires a year for its completion. In physics, four class-room exercises and three hours a week in the laboratory are required; in chemistry and biology, four class-room exercises and five hours a week in the laboratory in each subject.

3. Those who give evidence by examination that they possess the general education implied by a degree in arts or in science from an approved college or scientific school, and the knowledge of French, German, Latin, physics, chemistry, and biology above indicated.

Applicants for admission will receive blanks to be filled out relating to their previous courses of study.

They are required to furnish certificates from officers of the college or scientific schools where they have studied, as to the courses pursued in physics, chemistry and biology. If such certificates are satisfactory, no examination in these subjects will be required from those who possess a degree in arts or science from an approved college or scientific school.

Candidates who have not received a degree in arts or in science from an approved college or scientific school will be required (1) to pass, at the beginning of the session in October, the matriculation examination for admission to the collegiate department of the Johns Hopkins University, (2) then to pass examinations equivalent to those taken by students completing the Chemical-Biological course which leads to the A. B. degree in this University, and (3) to furnish satisfactory certificates that they have had the requisite laboratory training as specified above. It is expected that only in very rare instances will applicants who do not possess a degree in arts or science be able to meet these requirements for admission.

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Since the opening of the Johns Hopkins Hospital in 1889, courses of instruction have been offered to graduates in medicine. The attendance upon these courses has steadily increased with each succeeding year and indicates gratifying appreciation of the special advantages here afforded. With the completed organization of the Medical School, it was found necessary to give the courses intended especially for physicians at a later period of the academic year than that hitherto selected. It is, however, believed that the period now chosen for this purpose is more convenient for the majority of those desiring to take the courses than the former one. The special courses of instruction for graduates in medicine are now given annually during the months of May and June. During April there is a preliminary course in Normal Histology. These courses are in Pathology, Bacteriology, Clinical Microscopy, General Medicine, Surgery, Gynecology, Dermatology, Diseases of Children, Diseases of the Nervous System, Genito-Urinary Diseases, Laryngology and Rhinology, and Ophthalmology and Otology. The instruction is intended to meet the requirements of practitioners of medicine, and is almost wholly of a practical character. It includes laboratory courses, demonstrations, bedside teaching, and clinical instruction in the wards, dispensary, amphitheatre, and operating-rooms of the Hospital. These courses are open to those who have taken a medical degree and who give evidence satisfactory to the several instructors that they are prepared to profit by the opportunities here offered. The number of students who can be accommodated in some of the practical courses is necessarily limited. For these the places are assigned according to the date of application.

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NOTE ON THE COLLECTION OF HUMAN EMBRYOS IN THE ANATOMICAL LABORATORY OF JOHNS HOPKINS UNIVERSITY.

By Franklin P. Mall.

For a number of years past I have lost no opportunity to acquire human embryological specimens when found in any collection and have always urged physicians to send me any specimens they obtained in their practice. In addition I have written to many physicians for specimens, have sent out circulars and pamphlets in great number and have published requests in many of the medical journals. The result of this effort is a collection of specimens among the best in existence which has proved to be of great value in the study of human embryology and of anatomy in general. I take this opportunity to express my thanks to the many physicians who have often inconvenienced themselves in sending specimens to the anatomical laboratory.

The collection consists now of 208 specimens of young ova, both normal and pathological, over one-half of which were sent to me by physicians residing in Baltimore.[1] The specimens of the past five years are considerably better than the earlier ones, for many of them have been hardened in formalin, usually a ten per cent solution. To be sure, such specimens do not stain as well as when hardened in alcohol, but they retain their form, both internal and external. Excellent specimens are difficult to obtain, due to mechanical injury, delay in preservation and carelessness in shipping. The method which has given the best results is to place the entire specimen into a ten per cent solution of formalin as soon as possible and when it is to be shipped, place it in a bottle filled completely with the same fluid but without any packing around the specimen. Imitate the condition of a *fœtus in utero.*

Although embryologists have emphasized again and again the importance of preserving carefully early human embryos for study, it is necessary from time to time to remind physicians not to throw away the valuable material which is constantly coming into their possession. There are numerous questions which may be answered were there an abundance of specimens at hand, and they can be procured only through the cooperation of physicians in active practice. Not only do such specimens contribute to the study of human embryology but they are also of the greatest value in the study of the pathology of the embryo and of uterine

[1] From Maryland, 112; New York, 17; District of Columbia, 16; Pennsylvania, 11; Ohio, 7; Massachusetts, 6; Illinois, 6; Michigan, 4; California, 4; Iowa, 3; Wisconsin, 3; New Jersey, 3; Germany, 2; New Hampshire, 2, Tennessee, 2; Canada, 2; South Carolina, 2; Georgia, 2; Virginia, 1; Kentucky, 1; Colorado, 1; Maine, 1; North Carolina, 1; West Virginia, 1. Total, 208.

moles. In addition to morphological studies which may be made by the embryologists, the histories of the specimens are of the utmost importance in locating accurately the beginning of pregnancy and in determining the cause of pathological changes in the ovum in case it is diseased.

TABLE GIVING THE STATISTICS OF NORMAL AND PATHOLOGICAL SPECIMENS.

Number.	Normal.	Pathological.	Per Cent of Pathological.
First Month.			
1 to 126	18	14	44
127 to 208	8	19	70
1 to 208	26	33	56
Second Month.			
1 to 126	43	14	26
127 to 208	16	18	53
1 to 208	59	32	35
First and Second Months.			
1 to 126	61	28	32
127 to 208	24	37	61
1 to 208	85	65	43

Some statistics of the collection may be of interest. It may be noted that large specimens are not included in the records unless there are important data to be recorded. Of the 208 specimens 59 are of the first month, 91 of the second month and 58 over two months old. These figures include both the normal and the pathological specimens. Of the 150 specimens of the first and second months, 43 per cent are pathological, an increase in the per cent of pathological specimens in the collection five years ago. This is to be accounted for by the amount of selection there was made in the specimens before they were sent to me. The accompanying table gives the number of the specimens and per cent of pathological ones in the collection divided into two groups. Nos. 127 to 208 were collected during the past five years and Nos. 1 to 126 before that time. It will be seen that in both the first and the second months the per cent of pathological has increased markedly during the past five years. These latter figures are probably the more trustworthy, for in the 61 specimens of the first and second months collected during the past five years, practically no selection had been made by the physicians before they had sent them to me. So the statement may be made that about three-fourths of the abortions of the first month and about one-half of the second month give pathological specimens. These figures correspond much with those obtained by His but are considerably higher. In his collection 22 per cent of young ova were pathological, while if only the specimens which were obtained by midwives are considered, 40 per cent are pathological. Recently Prof. Kollmann has begun to collect all of the specimens obtained in the practice of a number of physicians in Basel and he informs me that hardly 3 per cent of them are normal. I think it probable that my highest figure, 75 per cent, would be further increased if my collection had been made in the same way Prof. Kollmann's was made. In the specimens collected during the past five years there are over half a dozen among them that are due to some kind of mechanical interference, either by the physicians who sent them or by some "professional" who preceded the physicians. About half of these are pathological, however, for the mechanical interference has started the destruction of the embryo.

From the study of the pathological ova the following conclusions have been drawn.

I. The embryo may become destroyed quite rapidly in young ova and in such cases the cause probably lies within the embryo itself, for in them the chorion is usually normal in appearance. The changes which do occasionally take place in the chorion of some of the specimens may be considered as secondary for the present. Under this heading there are three main subdivisions.

(1) The embryo is not formed or is destroyed in very young ova. Specimen No. 71 is the best representative of this type.

(2) The embryo is destroyed during the end of the second week, leaving only the umbilical vesicle (No. 180).

(3) The embryo is destroyed after the amnion is well formed, leaving only the umbilical cord (No. 198).

Varieties 2 and 3 may be changed into specimens without embryos by a further degeneration of the remnants of the embryo, thus leaving only the chorion, or the chorion and amnion, which may undergo a variety of secondary changes to form uterine moles.

II. Primary changes in the chorion may cause strangulation of the embryo which is followed by a variety of pathological changes. These may be brought together under two main heads.

(1) The strangulation may cause complete arrest of development of the embryo. In such cases the chorion continues to grow for a short time, the embryo becomes necrotic, ceases to grow and the tissues fill with blood-cells which wander from the blood-vessels.

(2) The strangulation only delays the development of the embryo. In such cases the chorion continues to grow for a long time, and its nutrition not being cut off entirely, the embryo continues to grow in an irregular fashion and a variety of pathological changes take place in it. The organs become irregular, usually degenerate and may wander. The tissues usually show fibrous atrophy and not infrequently there are all sorts of irregular hypertrophy.

The question most frequently asked about a human embryo is, How old is it? The answer could easily be given were it possible to locate accurately the beginning of pregnancy. The last menstrual period is usually assumed to mark this

time, but the more carefully the question is studied the more doubtful this assumption becomes. There are now a number of cases upon record in which conception could not possibly have taken place until after the last menstrual period, which are corroborated by the records of early human embryos. If this method of computing the age of an embryo and the duration of pregnancy is not correct, the younger the embryo the more apparent the error becomes. If the young embryos are arranged into two parallel lines, one according to their size, and the other according to their ages as computed by the last menstrual period, it will be found that 28 days will have to be added to some of the ages or subtracted from the rest in order to make even curves of the two lines.

Judging by the knowledge obtained from comparative embryology, embryologists have decided to subtract 28 from the larger figures rather than to add this sum to the smaller ones. The records of 37 embryos less than six weeks old show that in 8 of them their ages are to be computed from the last period, in 26 from the first lapsed period, and in 3 of them from some intermediate date. Furthermore, it is believed by embryologists that conception took place at the time of the last period in 8 cases or a few days before the first lapsed period in 26 cases. Until the exact date of the ovulation which gives rise to the conception is accurately located this question will not be fully settled.

If the embryologist's method of computing the age of human embryos is correct then embryos about one millimeter long are about 12 days old; 2.5 mm., 14 days old; 4.5 mm., 19 days old; 7 mm., 26 days old; 11.5 mm., 34 days old; and 17 mm., 41 days old. These figures are taken from exact records and by carrying them through I have found that their ages in days correspond remarkably well to the formula $\sqrt{100} \times$ length in mm. for all embryos from 1 to 100 mm. long. Multiply the length of the embryo from the vertex to the breech in millimeters by 100 and extract the square root and the result will be its age in days. In embryos from 100 to 220 mm. long from vertex to breech their length in millimeters equals their age in days.

In addition to the statistical and pathological studies of the specimens in the collection, two kinds of studies of the normal embryo are being carried on as rapidly as good specimens representing the proper stages are obtained. The first kind of study consists of working out every thing that can be recognized easily in the sections of a specimen by means of the wax-plate method of reconstruction. Embryo No. 2, a specimen of the end of the fourth week, was first worked out in this way. Later No. 12, a unique specimen of the end of the second week, was modeled in the same way. A model of No. 148 (3d week) is now being prepared by Mrs. Gage and it is hoped that an account of it will soon be published. Nos. 109 and 163 (5th week), 43 (6th week), and 22 (7th week) are gradually being modeled in our laboratory by Drs. Bardeen and Lewis and others, and in the course of time complete studies of these specimens will be ready.

The second group consists of studies of special tissues or of organs followed through a number of embryos. The excellent and laborious work of Drs. Lewis and Bardeen on group. Through this work we have now for the first time a knowledge of the development of most of the skeletal muscles of the human body. Incidentally this work has given the key by which a very elaborate set of records of the peripheral nervous system is being tabulated. I can heartily recommend these studies to the physicians and surgeons who constantly say that gross human anatomy is a finished science. On the contrary it is through embryology that the step in advance is to be made and through which human the development of the voluntary muscles belongs to this anatomy may become anthropological to produce in turn a new and rational regional anatomy.

There are a number of other studies of special questions in human embryology which are very valuable. I refer to them only by title in the bibliography of this brief communication. In addition the collection has often been used by those making studies in subjects closely related to human embryology; the bibliography gives references to them also.

EMBRYOS.

This list of embryos includes only those referred to in the papers given in the bibliography. The numbers of the embryos are given in Roman characters. Their length in millimeters follows in parentheses; p. indicates pathological. The Arabic figures following correspond with the numbers of the papers in the bibliography. When a figure is in italics it indicates that the description is also illustrated.

I (4½). Dr. Gavin, Baltimore. 13, 21, 27.
II (7). Dr. C. O. Miller, Baltimore. *1*, *2*, 4, *5*, *6*, *7*, *8*, 9, *10*, *11*, *12*, 13, *14*, *15*, *19*, 21, *24*, 27, *28*, *29*, *30*, *32*, 34, 35, *36*, *39*.
III. Prof. His, Leipzig, Germany. *10*, 30.
IV (7). Dr. Williams, Baltimore. 10, 30.
V (18½). Dr. Kittredge, Nashua, N. H. 10, 13, 21, 27, 30.
VI (24). Dr. C. O. Miller, Baltimore. 4, *10*, *11*, 13, *15*, *19*, 21, 22. 27, *30*.
VII (18). Dr. Booker, Baltimore. 30.
VIII (17). Dr. Ritter, Brooklyn, N. Y. 10, 30.
IX (17½). Dr. Eyelerhymer, Chicago. *10*, *11*, *15*, *19*, *22*, *30*.
X (24). Dr. W. S. Miller, Madison, Wis. *10*, *11*, *15*, 21, *30*.
XI (p). Dr. Kittredge, Nashua, N. H. *3*, *4*, *10*, 13, *21*, 27, *30*, *33*.
XII ($2\frac{1}{10}$). Dr. Ellis, Elkton, Md. 4, *10*, *11*, *12*, 13, *15*, *19*, *21*, *24*, 27, *28*, *30*, *32*, *36*, *39*.
XIII (p). Prof. His, Leipzig, Germany. 10, *21*, 30, *33*, 37.
XIV (p). Dr. Friedenwald, Baltimore. 10, *21*, 30, *33*.
XVI (7). Dr. Sherwood, Baltimore. 10, 13, 21, 27.
XVII (18). Dr. Cottell, Louisville, Ky. 10, 13, 21, 27, 30.
XVIII (7). Dr. Douglass, Nashville, Tenn. *10*, 13, *19*, 21, 27, *30*.
XIX (5½). Dr. Williams, Baltimore. *10*, 13, *19*, *21*, 27, *30*.
XX (p). Dr. Williams, Baltimore. 10, *21*, 33, 37.
XXI (p). Dr. Cullen, London, Canada. 10, *21*, 30, *33*.
XXII (20). Dr. Snively, Waynesboro, Penn. *10*, *12*, 13, *21*, 25, 27, *28*, *30*, *32*, *36*, *39*.
XXIII (70). Dr. Snively, Waynesboro, Penn. 13, 21, 27.
XXIV (p). Dr. C. O. Miller, Baltimore. 10, *21*, 30, *33*.

XXV (p). Dr. Lord, Baltimore. *21, 33,* 37.
XXVI (25). Dr. Simon, Baltimore, 13, 21, 27.
XXVII (23). Dr. Thayer, Baltimore. 13, 21, 27.
XXVIII (19). Dr. Sewall, Denver, Colo. 10, 13, 21, 27, 30.
XXIX (p). Dr. Booker, Baltimore. 10, 21, 33, 37.
XXX (60). Dr. Snively, Waynesboro, Penn. 13, 21, 27.
XXXI (24). Dr. Ballard, Baltimore. 13, 21, 27.
XXXII (p). Dr. Booker, Baltimore. 10, *21, 33,* 37.
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XXXV (13). Dr. C. O. Miller, Baltimore. 13, 21.
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XLII (18). Dr. Wills, Los Angeles, Calif. 10, 13, 21, 27, 30.
XLIII (16). Dr. Booker, Baltimore. *10, 12, 14, 19, 24,* 25, 26, *28, 30, 32, 36.*
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XLVI (135). Dr. Taylor, Baltimore. 13, 21, 27.
XLVIII (130). Dr. Wilson, Worcester, Mass. 10, *11, 15, 22,* 30.
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LIII (16). Dr. McMorris, Belle Plaine, Ia. 10.
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LVIII (p). Dr. Howard, Cleveland, Ohio. *21,* 30, 33.
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CX (8, p). Dr. West, Bellaire, Ohio. *21,* 33, 37.
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CXXIII (p). Dr. Boldt, New York. *21,* 30, *33,* 37.
CXXIV (35, p). Dr. Cassidy, Baltimore. *21,* 33, 37.
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NOTE ON THE FRAMEWORK OF THE THYROID GLAND.

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(From the Hearst Anatomical Laboratory of the University of California.)

In connection with some work on the digestive methods for the demonstration of the framework of organs, the writer had occasion to study the arrangement of the framework of the thyroid gland. This organ lends itself beautifully to the use of the destructive digestive method. The procedure employed in the preparation of the specimens used in this study has been fully described in a previous communication.[1]

A digested specimen of the thyroid after being cleared in glycerine forms a clear, glistening, highly refractive skeleton of the original block of tissue, preserving in general the form relations of the original block. The larger structures such as the blood-vessels and even the faint outlines of the follicles can be distinctly seen with the naked eye. Under the stereoscopic microscope the ultimate units of the structure are readily made out. The large vessels cut in cross section with their smaller branches radiating through the framework are recognized by the difference in diffraction resulting from the dense connective tissue with which they are embraced. In the thyroid there is no tendency for the follicles to accumulate into groups or become segregated by large septa of the framework, for there are no lobules or lobular membranes. The follicles apparently form in Ludwig's sense the true units of structure. The blood-vessels with their accompanying connective tissue make up the densest portion of the supporting framework and sometimes a suggestion of the lobular arrangement is given by these vessels as they ramify in the substance of the gland, but close focusing always reveals their exact nature. Almost the entire organ is made up of follicles, the form and relations of which are retained by the connective tissue which embraces them. The

[1] Flint: A New Method for the Demonstration of the Framework of Organs. Bulletin of The Johns Hopkins Hospital, vol. xiii, 1902.

reticulated basement membranes about the follicle are accentuated by the interfollicular framework. They stand out when near the surface as definite dark lines arranged in ovoid or spheroid shapes. The follicles are closely pressed against each other and do not look unlike a mass of superimposed bubbles with the nodes that outline their junction clearly shown in the depths. (Fig. 1.) The follicular membranes when viewed tangentially or in any other position than on edge are very transparent and can only be distinctly seen by rapid alterations in the quantity of light. Then they appear as fine, delicate membranes with a suggestion of the fibrillar structures showing under the high power. At the joints where two follicles unite, the framework appears somewhat thickened and prismatic in form, while at the nodes where three adjacent follicles come together the connective tissue takes the form of little pyramids. Small arterioles, venules and capillaries can be made out in the interfollicular framework or on the membranes which embrace the follicles. While the shape of the follicles is, in general, ovoid or spheroid,[2] they are so closely packed together that it is possible to find examples of almost any conceivable form; some are occasionally elongated, some polygonal, others prismatic, and still others almost cylindrical, but the predominating type is distinctly ovoidal or spheroidal. In studying the form of the follicles, the use of the stereoscopic microscope is especially desirable. When paraffin sections some 300 μ thick are made of a piece digestion of the human thyroid and stained in aniline blue, the form of the follicles is then seen with great distinctness. In some preparations the follicles look a trifle more irregular owing to the fact that the sharper stain brings out the details of their form. The reticulated membranes traversed by small fasciculi of fibrils are visible outlining the fascicular spaces. Between them there is considerable interfollicular connective tissue which is much more marked in some situations than in others. Quantitatively it is distributed chiefly with reference to the large vessels. Proportionally, however, it seems to be much greater in the human thyroid than that of the dog. At the points where the large vessels pass through the gland, the follicles are often jammed into the angles formed by their branches, and here the follicular membranes are attached by numerous fibrils to the adventitia of the vessels. This attachment, however, is not firm for there is often a tendency for the follicles to tear away at these points, and here one sees, when they are viewed tangentially, a definite mosaic form of the follicular membranes and their nodes. No framework passes into the interior of the follicles as the spaces formed by the membranes are completely empty. When the colloid and the follicular epithelium are digested the spaces remain empty. This is clearly shown by studying the edges of the block of tissue where the irregular border is formed by the projection of the follicular membranes. The larger follicles measure 0.3 mm. in diameter, the smaller 0.1 mm. The dimensions of the irregular follicles are more difficult to determine, but their longest diameter is seldom greater than that of the largest spheroidal follicles. In an adenoma of the thyroid prepared by this method, there is a distinct tendency to lobulation, the diameter of each lobule containing about eight or ten follicles. These, however, at the same time were somewhat smaller than those of the normal gland.

When sections are cut from the digested blocks and stained with fuchsin or aniline blue and studied under the high power, a considerable quantity of fasciculated connective tissue is seen about the large vessels. (Fig. 2a.) The fasciculi are longitudinal, corresponding in general to the long axis of the blood-vessels. There are, however, many intertwining and interlacing and circularly running fibril bundles as well, arranged so as to give at the same time greater strength and elasticity. From these septa the fibril bundles or fasciculi run in between the follicles and form the interfollicular framework. The follicles in man (Fig. 2f) are about four times larger than the follicles of the dog (Fig. 3f), and the reticulated basement membranes (Fig. 2m) appear much heavier. These, as in the case of the dog, are often separated by blood-vessels, which are cut either longitudinally or transversely. Points are found, however, where it appears as though a single membrane separated the follicles. Under the higher powers the fasciculi about the vessels and the interfollicular spaces are clearly brought out. The bundles of fibrils stain homogeneously but their exact nature is easily seen at the frayed ends or at points where they break up into the individual fibrils of which they are composed. Some follicles near the larger vessels are surrounded by thick septa while those away from the larger vessels have a more delicate envelope. These when cut transversely, under the lower powers, look like irregular fine lines, but under the higher powers, however, the usual fibrils composing them can be easily seen. In the membranes which are cut tangentially the fine delicate fibrils that branch and anastomose and run in all directions are readily made out. At times fine fibril bundles run across the basement membranes. These, in some places, form the walls of the capillaries. At the follicular nodes, the fibrils and finer fibril bundles interlace with each other, thus locking the membranes together. Even in complete digestions, the meshwork of fibrils seems to possess a different diffraction from the clear spaces within the follicles. This may be due to the presence of an undigested homogeneous material left in the meshwork or simply represent the expression of some physical phenomenon of diffraction.

In piece digestions of the dog's thyroid the capsule can often be split into layers like that of many other glands, an outer looser layer and an inner which is more definitely adherent to the connective tissue of the parenchyma of the

[2] Streiff (Arch. f. mik. Anat., xlviii) has reviewed the literature on the shape of the thyroid follicles and has studied their form by means of the wax plate method. He concludes that the follicles do not communicate with each other but are in the form of closed vesicles separated from each other by connective tissue fibrils. Most of the follicles are in the form of round, ovoid or polyhedral vesicles but forms which appear either like tubules or even-branched follicles are sometimes found.



FIG. 1.—Piece digestion of the human thyroid fixed in Van Gehuchten, extracted with ether, digested with pancreatin, and cleared in glycerine drawn with stereoscopic microscope. Magnified 13 diameters.

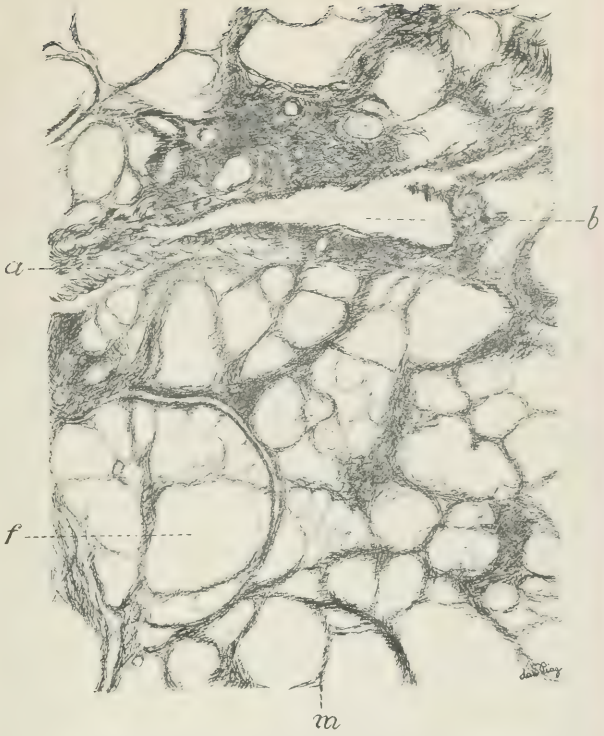


FIG. 2.—Sections of the block of tissue from which Figure 1 was drawn. Stained with aniline blue. Magnified 60 diameters.
a = fasciculated connective tissue about blood-vessels.
b = blood-vessels.
f = follicle.
m = reticulated basement membrane.

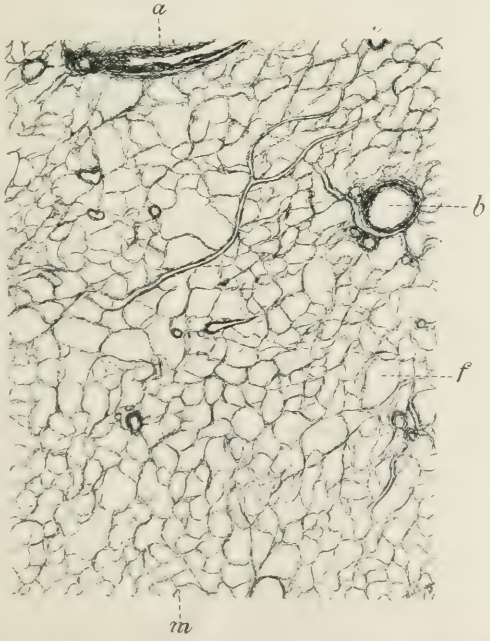


FIG. 3.—Sections from piece digestion of dog's thyroid. Same preparation and same stain as Figure 2. Magnified 60 diameters.
a = fasciculated tissue about blood-vessels.
b = blood-vessels.
f = follicle. *m* = reticulated basement membrane.

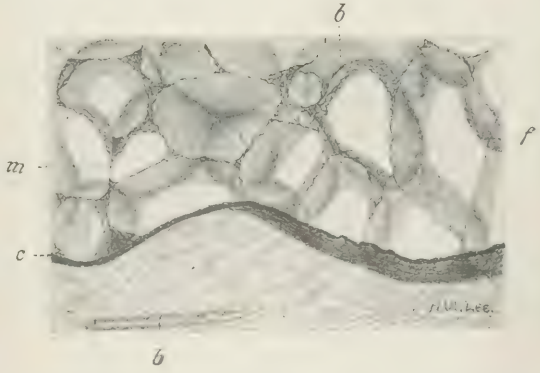


FIG. 4.—Section of piece digestion of dog's thyroid 150μ thick stained with aniline blue, drawn with stereoscopic microscope. Magnified 180 diameters.

gland. Blood-vessels penetrate from the capsule and carry with them the larger processes of connective tissue derived from that structure. But there are throughout the gland no definite septa or connective tissue processes, which divide it into units of structure comparable to lobes or lobules. The follicles are, like those of the human gland, chiefly spherical or ovoidal in shape, although it is possible to find many bizarre forms. They average approximately one-fourth the diameter of the human follicle. Here as in the human gland the form of the follicles are seen best in sections about 150μ thick stained with aniline blue (Fig. 3). The form and structure are brought out with greater sharpness than when the larger blocks are simply cleared in glycerine. In such preparations the follicles look a trifle more irregular owing to the fact that the sharper stain brings out the details of their form. The reticulated membranes show as fine faint blue webs bounding the follicles and with the high power the fibrils of which they are composed are distinctly visible. The interfollicular connective tissue is scant save in the neighborhood of the great vessels.

The basement membrane and the interfollicular framework are very clearly seen even in the glycerine specimens as fine lines with nodal points of junction. Between them the smaller blood-vessels ramify. The thyroid of the monkey has all the characteristics of the organ in the dog and the arrangement of its framework corresponds almost in all particulars in the two animals except that the follicles are nearly twice as large. In certain specimens it is possible to find the parathyroid. This is included in the general capsule of the thyroid in both dog and monkey but is separated from the follicular portions of the organ by a distinct fibrous capsule which embraces the smaller gland. The framework of the parathyroid is made up of small spaces bounded by delicate septa in which the ramifications of the blood-vessels can be seen. In unstained specimens of piece digestions the arrangement of the fibrils is so delicate that their structure and arrangement are not evident unless they have been previously stained with fuchsin or some similar dye. When sections are made of piece digestions of the dog's thyroid and stained with aniline blue, the perifollicular membrane and the connective tissue processes about the larger vessels can be resolved into their ultimate fibrillæ. No large processes of connective tissue are seen except in the neighborhood of the great vessels. The perifollicular membranes and the interfollicular connective tissue are all fibrillated. The fibrils around the follicles are arranged in the form of a dense, interlacing meshwork (Fig. 3m) so as to form distinct reticulated membranes. If septa have existed in the thyroid of the human being, dog or monkey at any stage of their development they have been lost in the subsequent development of the gland. Such a state of affairs would be comparable to the condition found in the submaxillary gland where the primitive septa, which in the embryo divide the gland into definite lobes, subsequently lose these relations in the further development of the organ. There has been noticed in sections of the thyroid of a human embryo a tendency for groups of follicles to be bound together by connective tissue processes. This arrangement has also been observed in one pathological gland, of which mention has been made above.

It is interesting to speculate on the role played by the follicles and their membranes in reference to the secretion of the gland. By many it has been supposed that the follicles enlarge until they rupture like the Graafian follicles of the ovary and that their contents are then carried to the systemic circulation through the lymphatics. Others have held that the products of glandular activity passed into the circulation through the membranes by osmosis. At any rate in the specimens of human, dog's and monkey's thyroid where the membranes are distinctly visible, no evidence of rupture is seen in any of them. The meshes are unquestionably large enough for the nourishment and end-products of glandular activity to pass to and from the cells through the reticulated membranes.

THE RESULTS OF SOME OBSERVATIONS ON BLOOD-PRESSURE IN MORBID CONDITIONS IN ADULTS.[1]

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(*Read before the Johns Hopkins Hospital Medical Society, November 17, 1902.*)

Two cases were reported to illustrate the interest of blood pressure determinations in the study of cardiac diseases. Both cases presented the picture of broken compensation in connection with lesions of the mitral valve. In one patient the blood pressure, as measured by a modified Riva-Rocci sphygmomanometer, was abnormally low; in the other case it was markedly raised. In both patients there was a return of the blood pressure to normal limits under esentially the same treatment, digitalis and rest in bed, with free purging. The conclusion was that the digitalis drugs are not necessarily, as they are used clinically, bound to raise the arterial blood pressure.

[1] Abstract of a paper by John Bradford Briggs, M. D., and Henry Wireman Cook, M. D., to be published in full later.

The value of a knowledge of the blood pressure in the diagnosis of obscure comatose conditions was illustrated by the second case, in which a large cerebral hemorrhage was found post mortem projecting into the lateral ventricle. During life the patient, who was brought into the hospital deeply comatose, with all reflexes gone and without localizing symptoms, was supposed to be uræmic on account of the character of the urine, and was subjected to free venesection. The blood pressure was enormously high, beyond the limits of accurate measurement, but at least equal to 400 mm. Hg. In view of Cushing's demonstration of the relations between intracranial and arterial pressures, and in view of the fact that in the rather scanty literature and also in their own experience they have been unable to find the record of any such pressures in nephritis or uræmia, the authors believe that in any case similar to theirs the diagnosis of intracranial hemorrhage could be based on observations of the blood pressure alone.

Especial attention has been paid to the study, by means of a modified Riva-Rocci instrument, of cases receiving routine or occasional stimulation in the wards of the Johns Hopkins Hospital. Continuous series of observations were obtained, at intervals of from two to five minutes for many hours, of the maximum arterial blood pressures in a varied set of cases during the period in which they were receiving one or another of the stimulant drugs. A continuous record of the pulse rate was obtained in each case also.

The effects of alcohol on the pulse, given as whiskey or brandy by the mouth, were never marked. Usually in non-alcoholics and in patients who have received but little alcohol previously as medicine, the ingestion of ʒss-i of whiskey will produce a temporary rise in blood pressure, never lasting over thirty minutes, and typically followed by a slight but more permanent fall below the previous level. In some patients this fall is not preceded by any rise in blood pressure, and while it is occurring the pulse may actually feel of better quality to the finger. The total effect of alcohol then, on the vaso-motor system, is depression, *Gutnikow* having demonstrated its action in diminishing the reflex sensibility of the center in the medulla itself. The character of the blood pressure curve following the administration of alcohol by mouth, suggests that its primary effects on the pulse may be largely or in part reflex from gastric irritation. In this connection it was found that after the ingestion of 10-15 drops of tincture of capsicum a rise in blood pressure was observed of equal or even slightly greater duration than that seen after the administration of whiskey, ʒiv to vi, in the same patient. The rise in blood pressure produced by tincture of capsicum was not followed by any fall, as in the case of whiskey.

Strychnia hypodermically in moderate doses was found to cause a rise in pressure somewhat delayed as compared with that after alcohol, but continuing with far more steadiness, and persisting for from one to three hours. A similar rise in blood pressure, with more rapid onset and somewhat less permanent, was found to follow the administration of digitalin. The blood pressure raising effect of these drugs was not followed by any phase of depression, as in the case of alcohol. During the routine administration of these stimulants, especially with strychnine given over long periods, the blood pressure response to any single dose may be apparently absent, and in any case will be less marked than that following the first few doses given to the patient, but in these circumstances if the routine order be suspended for one or two periods, the blood pressure will be seen to fall in the absence of the stimulant, to return to its former level when the drug is resumed. This constant blood pressure level, as maintained by the use of strychnine and digitalin at regular intervals, represents the ideal to be sought after in the stimulant treatment of the toxic conditions, as illustrated especially in the severe cases of typhoid fever. In this class of cases alcohol, not being a true cardio-vascular stimulant, does not contribute to the maintenance of the "stimulation level" of the blood pressure curve, and the rational basis, for its use must be sought in some alteration of metabolism, and not in any assumed improvement of the force of the pulse.

Subcutaneous infusions of normal saline solutions have no stimulant effect on the pulse. When given slowly and at temperatures not exceeding 37° C., there is no change in the blood pressure level during or following their use. Given more rapidly, and at higher temperatures, they produce a quite transitory rise in blood pressure, which is obviously parallel to the amount of local irritation produced. In cases of collapse of the circulatory system due to severe hemorrhage, saline infusions may accentuate the natural tendency of the blood pressure to return to normal levels. Our results indicate that it is useless to infuse with any idea of filling up the depleted vessels; the water and salt are excreted probably quite as rapidly as they pass into the circulation. In surgical and traumatic shock, whose essential feature is a perilously low blood pressure, saline infusions are absolutely contraindicated—we have never seen such a case in which the subcutaneous administration of normal salt solution by the ordinary method did not produce a further fall in the blood pressure, an aggravation of a condition already sufficiently alarming.

On the other hand, cases of pure shock, quite uncomplicated by any of the severe symptoms of hemorrhage, or with those symptoms superadded, will frequently respond to the true cardio-vascular stimulants by prompt and steady increase in the blood pressure. The use of strychnia and digitalin seems to meet the first indication in the treatment of many cases of shock, and the best way to use them seems to be to give such quantities as will have the best effect on the blood pressure. In all classes of cases, medical and surgical, a study of the blood pressure is the most accurate guide to the use of the stimulant drugs.

THE CLINICAL VALUE OF BLOOD-PRESSURE DETERMINATIONS AS A GUIDE TO STIMULATION IN SICK CHILDREN.[1]

By Henry Wireman Cook, M. D.,

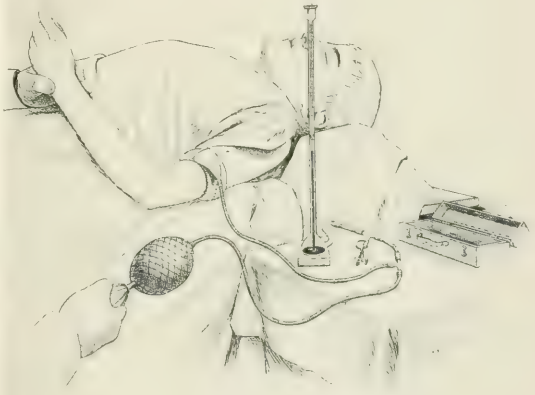
Resident House Officer, Johns Hopkins Hospital; Late Assistant Resident Physician, Thomas Wilson Sanitarium.

(*From the Clinical Department of the Thomas Wilson Sanitarium for Sick Children.*)

The introduction into clinical medicine within the past few years of a practical means of numerically representing pulse force marks an advance in the possibility of accurate judgments in morbid conditions that deserves to rank with the methods for determining the degree of anæmia, leucocytosis, or pyrexia. Though the trained touch of the clinician may be sensitive to even slight immediate changes in pulse force, still the indefinite basis afforded by mental impressions of which no accurate record can be kept makes it impossible that variations in pulse force from hour to hour or day to day could be followed with any degree of certainty. Thus an apparatus which not only gives in numerical terms an equivalent of existing arterial tension but also makes possible the graphic representation of its variations under treatment, puts the clinician in closer touch with the patient's condition by the difference between vague estimates on pulse force and its actual equivalent in millimeters of mercury. If the accurate estimation of blood pressure from tactile impressions is difficult in adults it is doubly so in children where the tension is by comparison low and the rate high. The most trained touch would find it difficult to detect any but marked changes in a child's pulse force where there is a pressure of 80 millimeters of mercury and a rate of 180. Yet comparatively trivial causes may send the pulse rate of a child to that figure and it is extremely important to know if this is accompanied by an actual drop in pulse force, thus indicating the need of a stimulant.

In view of the difficulty of regulating stimulation in sick children by the symptoms ordinarily observed, such as pulse rate and character, temperature, and general condition, routine blood pressure determinations were made last summer at The Thomas Wilson Sanitarium with the idea of obtaining in this way a more accurate criterion for the choice and administration of stimulants.

The instrument found most convenient and suitable (see cut) is a modification of the original Riva-Rocci sphygmomanometer, and while differing from that apparatus in manner of construction, embodies the same principle.[2] A closed system of air connects a rubber bulb held by the operator, a rubber band placed around the middle of the upper arm of the patient and a mercury manometer. The operator increases the pressure within the closed system, simultaneously compressing the arm of the patient and raising the mercury column of the manometer. According to the physical law of gases equal pressure is being applied at every point in the air system. When the patient's pulse is obliterated in the radial at the wrist, the height of the mercury column will approximately represent the maximum arterial blood pressure.



A model of the original instrument was found unwieldy for bedside use and impracticable for carrying from place to place. It was found possible to have a manometer made entirely of glass with but one outlet tube to the mercury reservoir, and so jointed in the middle that it could be packed into a very easily portable box. The tubing and connections were also simplified as much as possible. The mercury manometer was considered an essential for registering the pressures, as the spring and aneroid devices used with some instruments are unavoidably subject to errors of adjustment.

In recording observations, use was made of the graphic chart method after Cushing, and the pulse rate was noted with each blood pressure observation. In determining the effects of any stimulant treatment, as far as possible repeated pressures at short intervals, such as five minutes, were taken for some time before the treatment was begun, during its administration and while its effect lasted. Preliminary observations were made on cases not requiring stimulation, such as healthy children and convalescents, in order to obtain

[1] Abstract of a paper read before the Johns Hopkins Hospital Medical Society, November 17, 1902, and to be published in full in American Journal of Medical Science, March, 1903.

[2] A very satisfactory model of this modification intended for use by the general practitioner has been put on the market by Messrs. Eimer and Amend, 205–211 3rd Ave., New York

some idea of normal limits. During the first six months we may expect a blood pressure of from 75 to 90 millimeters; during the second year from 85 to 95 millimeters, and during the rest of early childhood from 90 to 105 or 110 millimeters. The blood pressure of children was found to be a much more absolute quantity than in the adult when arteriosclerosis and great differences in musculature have to be taken into account. For a child over 18 months of age 80 may be considered moderately low, 70 to 75 low, and 60 very low. Physiological rises in blood pressure occur in a healthy child from crying, pain, coughing, or any form of excitement and after feeding, but these normal reactions do not as a rule confuse observations on cases requiring stimulation, as such a child is so often listless and cannot take much nourishment and the vasomotor system seems unable to respond to physiological stimuli.

Observations directed toward determining the effect of the routine stimulant treatments upon the blood pressure gave the following results: Alcohol was unsatisfactory for immediacy, permanency, or reliability as a stimulant in single doses. In repeated doses it appeared to have a marked and permanent beneficial effect. Thus it would seem not to be indicated where urgent stimulation was required, while very useful during the course of a depressing toxic or marantic illness where, besides its doubtful stimulant action, it is of value as a conserver of energy in the nature of a food. Strychnine was found to have a more positive effect on the blood pressure. Hypodermic doses of 1/400 gr. to infants during the first year and 1/200 gr. during second year and 1/100 during early childhood, as a rule, produced a rise in blood pressure in 10 to 20 minutes which was well maintained for two to six hours, as long as the child was not moribund. Digitalin hypodermically in equal doses acts more quickly and produces a higher rise in blood pressure, but the elevation is not maintained for so long a period. The rise usually begins in from 5 to 10 minutes, may reach as high as 20 or 30 millimeters and lasts one or two hours.

Children that do not need stimulation do not show these marked responses to strychnia and digitalin, nor do the moribund when the vasomotor center is insensitive to stimulants. It is in the large intermediate class of toxic and marantic conditions accompanied by a low tension pulse, met with in pediatrics, that carefully regulated drug stimulation is so satisfactory in its beneficial results. Many desperate cases may actually be kept alive for days by the artificial vitality of drug stimulation, in the hope meanwhile that eliminative or recuperative powers may overcome the morbid process.

Infusions of normal saline solution were found unsatisfactory for any true stimulant effect, though they seemed useful in some toxic and wasting conditions either by increasing elmination or supplying needed fluid to the tissues. They seem inadvisable in any acute prostration or collapse as the afferent impulses from the needle puncture and local tissue distension only make further drains upon the lowered vitality. In these conditions, digitalin, which acts most promptly, is the drug of choice, followed by strychnine, which maintains the bettered condition.

With this knowledge of the effect of drugs on the circulation as a basis, blood pressure determinations were made in cases requiring stimulation and the stimulants were administered with the view of maintaining fairly equable and approximately normal tension in the arterial system, believing that such a condition favored recovery.

It was found that by routine determinations every one, two or three hours according to the severity of the case, variations in blood pressure could be met and corrected by regulating the stimulants according to the indications of the blood pressure chart. At night, especially, where the children could not be kept under such close medical surveillance, blood pressure observations were found very useful in avoiding errors in the quantity or period of stimulation. The night nurse making occasional determinations, regulated the stimulant by the indication so afforded, and this method seemed a much safer index for the prevention of either over stimulation, or lowered vitality and collapse, than the usual periodic routine order.

It would seem practicable in hospitals or private practice, where trained nurses are employed, that a chart of arterial tension should be kept in addition to a chart of pulse and temperature to afford a better guide for stimulative treatment. Without a nurse the practitioner may make once or twice daily a blood pressure determination to supplement his more general impression of the case as to the necessity and amount of stimulation required.

In conclusion: Although it must not be inferred that blood pressure observations are considered the only measure of a patient's condition, or that any single observation necessarily gives an absolute indication for treatment, still, in general, it would seem that blood pressure observations which constitute a numerical index for the mechanism most affected by stimulation would be the best single guide to the choice and administration of stimulants.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

Volume XIII is now completed. The subscription price is $1.00 per year. The set of thirteen volumes will be sold for $32.00.

RESOLUTIONS ON THE DEATH OF DR. HENRY W. OCHSNER.

At a meeting of the University of Wisconsin Alumni Association, on the twenty-fifth of November, 1902, in the Young Men's Christian Association room of the Johns Hopkins Medical School, presided over by Dr. Guy L. Hunner, the following resolutions were adopted:

Whereas, We have lost by death our beloved colleague, Henry William Ochsner;

Be it Resolved, That we, the University of Wisconsin Alumni Association of the Johns Hopkins Medical School and Hospital, do express to his family our heartfelt sympathy in their great bereavement.

During years of association at the University of Wisconsin, at the Johns Hopkins Medical School, and in the Johns Hopkins Hospital, we have grown to love him for his purity of character, his devotion to duty, and his fidelity as a friend.

And, Be it Further Resolved, That a copy of these resolutions be transmitted to his family and published in the Bulletin of the Johns Hopkins Hospital, in the University of Wisconsin Alumni Magazine, in the Daily Cardinal, and in the Buffalo County (Wisconsin) Journal.

Frederick J. Gaenslen,
Kenelm J. Lee,
Arthur W. Meyer,
Committee.

NOTES AND NEWS.

Dr. Herbert W. Allen, House Medical Officer during 1900 and 1901, resides at 546 Sutter Street, San Francisco, California.

Dr. A. D. Atkinson, Assistant Resident Physician in 1895 and 1896, is Associate in Clinical Medicine, University of Maryland, and Visiting Physician to the Children's Hospital. Address: 21 West Chase Street, Baltimore.

Dr. John M. Berry, House Medical Officer in 1901 and 1902, resides at 22 Lancaster Street, Albany, N. Y.

Dr. Milton Bettmann, House Medical Officer during 1900 and 1901, died in Paris, May 30, 1902.

Dr. E. Bates Block, Assistant Resident Physicion in 1896 and 1897, is Lecturer on Nervous Diseases in the Atlanta College of Physicians and Surgeons, Visiting Physician to the Presbyterian Hospital, Neurologist to the Tabernacle Infirmary, and a member of the Board of Medical Visitors to the Public Schools, Atlanta. Address: 713 Empire Building, Atlanta, Ga.

Dr. George Blumer, Assistant Resident Surgeon from 1893 to 1894, Assistant Resident Physician from 1894 to 1895, and Assistant in Pathology from 1895 to 1896, is Professor of Pathology and Bacteriology in the Albany Medical College and Director of the Bender Hygienic Laboratory. Address: 247 State Street, Albany, N. Y.

Dr. Charles H. Bunting, House Medical Officer during 1901 and 1902, is Assistant Demonstrator of Pathology, University of Pennsylvania. Address: Medical Hall, University of Pennsylvania, Philadelphia, Pa.

Dr. W. J. Calvert, appointed House Medical Officer in 1898 but did not enter upon service, is Lecturer on Tropical Diseases in the Medical Department of Washington University, St. Louis, Mo. Address: 3732 Olive Street, St. Louis, Mo.

Dr. C. N. B. Camac, Assistant Resident Physician in 1896 and 1897, is Instructor in Clinical Pathology, Cornell Medical School, Chief of Clinical Department of General Medicine of the Cornell Dispensary, and Visiting Physician to the City Hospital, New York. Address: 108 East 65th Street, New York City.

Dr. A. W. Elting, House Medical Officer in 1898 and 1899, is Surgeon to the Child's Hospital, Albany, and Chief of Surgical Clinic, Albany Hospital. He is also Lecturer on Surgical Pathology in the Albany Medical College, and Teacher of Clinical Surgery in both the Child's and Albany Hospitals, as well as Secretary of the Albany County Medical Society. Address: 247 State Street, Albany, N. Y.

Dr. McPheeters Glasgow, Assistant Resident Gynecologist in 1896, is Visiting Surgeon to the St. Thomas Hospital, Nashville, Tenn. Address: 151 North Spruce Street, Nashville, Tenn.

Dr. Norman B. Gwyn, Assistant Resident Physician from 1896 to 1900, is Instructor in Medicine, University of Pennsylvania. Address: 225 South 20th Street, Philadelphia, Pa.

Dr. Henry Harris, House Medical Officer in 1899 and 1900, is Instructor in Physical Diagnosis, Cooper Medical College, and First Assistant in the Medical Clinic, Cooper Medical Dispensary. Address: 502 Sutter Street, San Francisco, California.

Dr. T. W. Hastings, House Medical Officer in 1898 and 1899, is Assistant Attending Physician, Department of General Medicine, Cornell Dispensary. Address: 72 West 87th Street, New York City.

Dr. Joseph H. Hathaway, House Medical Officer in 1901 and 1902, is a member of the medical staff of the Glen Springs, Watkins, N. Y.

Dr. J. M. Hitzrot, House Medical Officer in 1901 and 1902, is Ambulance Surgeon to the New York Hospital, New York.

Dr. Louis W. Ladd, House Medical Officer in 1900, is Clinical Microscopist to Lakeside Hospital and Lecturer on Clinical Microscopy, Western Reserve University Medical School. Address: The Montana, Cleveland, Ohio.

Dr. David R. Lyman, Assistant Resident Obstetrician in 1900 and Assistant Resident Surgeon in 1901, is Assistant Resident Physician, Adirondack Cottage Sanitarium, Saranac Lake, N. Y.

Dr. Irving P. Lyon, House Medical Officer during 1897 and 1898, has resigned his position as Clinical Pathologist at the New York State Pathological Laboratory, Buffalo. Address: 531 Franklin Street, Buffalo, N. Y.

Dr. J. D. Madison, House Medical Officer in 1898 and 1899, has resigned his position as Assistant Physician at Danvers Insane Hospital, Hathorne, Mass., and is at present located at 199 Twenty-third Street, Milwaukee, Wis.

Dr. H. W. Ochsner, appointed House Medical Officer for 1902, died of typhoid fever at the Hospital, November 25, 1902.

Dr. Richard F. Rand, House Medical Officer during 1900 and 1901, has resigned his position as Resident Surgeon at the Parker Hospital, University of Missouri, and is at present located in New Haven, Conn. Address: 220 Orange Street, New Haven, Conn.

Dr. Hunter Robb, Resident Gynecologist from 1889 to 1892, is Professor of Gynecology, Western Reserve University. Address: 702 Rose Building, Cleveland, Ohio.

Dr. Maurice Rubel, House Medical Officer during 1901 and 1902, resides at 3341 Wabash Avenue, Chicago, Ill.

Dr. J. M. Taylor, Assistant Resident Gynecologist in 1900 and 1901, is located at the Pierce Building, Boise, Idaho.

Dr. Paul G. Woolley, House Medical Officer in 1900 and 1901, has been appointed to the position of Pathologist and Bacteriologist at the Government Laboratories in Manila, P. I.

Dr. Sarah D. Wyckoff, House Medical Officer during 1899 and 1900, resides at 68 West South Street, Wilkes-Barre, Pa.

Dr. J. L. Yates, House Medical Officer in 1899 and 1900, and Assistant Resident Surgeon in 1901, is Instructor in Pathology, University of Pennsylvania. Address: The Bartram, Philadelphia, Pa.

NOTES ON NEW BOOKS.

Text-Book of Medical Jurisprudence and Toxicology. By JOHN J. REESE, M. D. Sixth edition. Revised by Henry Leffman, A. M., M. D., Professor of Chemistry and Toxicology in the Woman's Medical College of Pennsylvania. Price $3. (*Philadelphia: P. Blakiston's Son & Co., 1012 Walnut St., 1902.*)

The portion of this volume which treats of Medical Jurisprudence is written clearly and sensibly and furnishes the modicum of information desired by physicians and general practitioners who may be called upon to seek a guide in an occasional excursion into the misty field of law as applied to medicine. There are excellent chapters upon wounds, injuries, the identification of the dead, and the various forms of violent death. We are gratified to find that the author doubts the possibility of spontaneous combustion, that old-time "will-o'-the wisp" of science, and very sensibly adds: "Although some remarkable instances are related of apparent spontaneous combustion of the human body, originating while alive, on close investigation it will be found that some source of fire had invariably been present, from which the combustion took its origin, such as a lighted pipe or candle, and that the body was that of a habitual spirit drinker and nearly always that of a very fat person, conditions favorable for the process of combustion when once originated." We notice that reference is made under asphyxia to the necessity of a spectroscopic examination of the blood to detect the presence of carbon monoxid.

The section on insanity, although concise, is generally satisfactory. The use of the term "partial moral mania" is not in accordance with modern views and hence is misleading. It should be banished from the terminology of treatises on the medical jurisprudence of insanity.

The best portion of the book and one which is worthy of the highest praise is that which treats of Toxicology. In this are given a detailed account of the action of poisons, their behavior in the animal body, the antidotes for them and the means of detecting them when they remain in the tissues after death. These various details are presented clearly and systematically and the knowledge which is to be acquired by the student is modern and sufficiently full to constitute a safe guide. We are gratified to see a special reference to the toxicity of wood alcohol. The book is worthy of general use.

A Text-Book of Histology and Microscopic Anatomy of the Human Body, Including Microscopic Technique. By LADISLAUS SYMONOWICZ, A. O., Professor of Histology and Embryology in the University of Lemberg. Translated and edited by John Bruce MacCallum, M. D., Johns Hopkins University, Baltimore. In one octavo volume of 435 pages, illustrated with 277 engravings, including 57 plates in color and monochrome. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

Symonowicz's "Lehrbuch der Histologie und der mikroskopische Anatomie" was published in several parts, which appeared at intervals during the last few years and attracted attention by reason of the superiority of its contents, more particularly by reason of the excellence of its illustrations, many of which are in the form of colored lithographic plates. Its appearance

in the form of a carefully edited American edition must, therefore, be regarded as a distinct addition to the text-books of Histology, now at the command of instructors teaching English-speaking students. The editor's preface contains the statement that "the spirit and characteristics of the German original have been carefully retained, changes in the text and illustrations being made only when some distinct advantage was attained. Those changes resulted mostly in enlargements." A familiarity with both the original and this new edition enables one, however, to detect in the latter numerous alterations in both text and illustrations, which are distinctly to its advantage.

About one-third of the text is devoted to the consideration of the tissues, which are classified under the heads of epithelial and glandular tissues, supporting and interstitial tissues, muscular tissues and nerve tissues. The remainder of the text (exclusive of some forty pages, devoted to general and special technique) is given up to a consideration of the microscopic anatomy of the organs. Throughout the entire work consideration is given not only to the structure of the tissues and organs in their full development, but also to their histogenesis, which is discussed in the light of most recent investigations and is given much more fully than is generally the case in text-books of histology, and in this respect Dr. MacCallum has added materially to the usefulness of this volume.

In discussing the microscopic anatomy of organs and glands, the editor has departed in many respects from the original text, especially in giving emphasis to the structural units to be recognized in many of them; this necessitated a fuller consideration of the vascular supply of the organs and the addition of a number of figures obtained from reconstructions made from serial sections of injected preparations. In considering the structure of the liver and kidney, in which organs there is not observed a definite separation into toxic units of structure, suggestions are made concerning the existence of secretory and blood-vascular units, which will serve to elucidate the microscopic anatomy of these organs. In thus emphasizing the existence of structural units in glands and organs and collating from the literature figures where such units are portrayed in a pictorial way, the editor has rendered a notable service not only to the students of normal histology, but also to the students of pathologic histology. Among the additions made, attention should be drawn also to the excellent, but perhaps too brief description of the medulla and mid-brain, for which the editor is indebted to Dr. Sabin, illustrated by a number of figures showing sectional views of a model of this portion of the central nervous system, made by Dr. Sabin according to the Born wax-plate reconstruction method.

The text, as a whole, is clear and concise, and in general the views expressed in it are those found in the latest literature and the space allotted to the discussions of the various tissues and organs is in general in proportion to their importance. In the excellent chapter on the muscular tissues is felt the influence of Dr. MacCallum's own investigations. The chapters on the connective tissues and on the adenoid tissues and organs are based largely on the results of observations made in the Anatomical Laboratory of the Johns Hopkins University; indeed, the influence of the numerous researches which have emanated from this laboratory are felt throughout the whole work. In a future edition, somewhat more space might with propriety be allotted to a consideration of the elements of the blood and more particularly to those of the lymph and a fuller discussion of their relation to the hematopoietic tissues might be considered. The same may also be said concerning the general subject of the innervation of the organs, which is treated on the whole less satisfactorily than are their lymph and blood-vascular supply.

Nearly all of the illustrations of the German original, the majority of which are exceptionally good, are retained and Dr. MacCallum has shown very good judgment and a thorough knowledge of the subject in the selection of the thirty illustrations that have been added. Here and there the presence of additional illustrations could not be considered superfluous—for example a figure showing an island of Langerhans—but in treating so comprehensive a subject in a relatively brief space, the difficult question is not what should be discussed and figured, but what may with propriety be omitted.

That portion of the text which deals with general and special microscopic technique contains brief descriptions of the more generally known methods used in the preparation of tissues and organs for microscopic study; it must be said, however, that somewhat fuller treatment, more particularly of certain of the special methods mentioned, would render this section more serviceable to the beginning student. The volume contains an author's index and a very good general index, with numerous very useful cross-references.

In conclusion it may be said that it is a pleasure to review a work, which presents so many admirable features and which is so singularly free from even minor errors, one which can be so warmly recommended. Dr. MacCallum has shown excellent judgment in his capacity as editor and has rendered a distinct service in placing this work within the reach of English-speaking students. He is to be sincerely congratulated.

The Diseases of the Nose, Throat and Ear. By CHARLES P. GRAYSON, A. M., M. D., Lecturer on Laryngology and Rhinology in the Medical Department of the University of Pennsylvania; Physician in Charge of the Department for Diseases of the Nose and Throat in the Hospital of the University of Pennsylvania; Laryngologist and Otologist to the Philadelphia Hospital. Illustrated with 129 engravings and 8 plates in colors and monochrome. (*Philadelphia and New York: Lea Brothers & Co.*)

The superior excellence of this work is the only excuse necessary for its appearance in a field already somewhat crowded. Dr. Grayson has not attempted to make this an exhaustive resume of the subject with a statement of all the conflicting views upon the different diseases and their treatment, but has, instead, fully considered all the affections of these organs that are commonly met with and presented the plan of treatment in each case which has in his own experience proven most satisfactory. While such a method seems dogmatic it has, nevertheless, certain advantages. The student is not embarrassed by contradictory opinions, the value of which he is not able to determine, and the physician, in appealing to such a book, derives all the benefits of a personal consultation with the author.

The book is deserving of our highest praise. Taken in its entirety it presents a high standard throughout. Every topic is presented in a modern, up-to-date way. It is difficult to select any chapters for special consideration unless the reviewer takes those that interested him most or which seem to be most worthy of the special attention of his readers. The chapter on hay fever appealed to us strongly because of the existence of that affection in our family and because we were just recovering from our own initial attack. We suspect the author has been a victim himself, for he describes the symptoms with so much feeling; at any rate, he presents here the best article on the subject, from etiology to treatment, that we have seen.

We wish to direct the especial attention of physicians in this part of the country to what Dr. Grayson has to say of adenoid growths. His plea for their complete removal at one operation receives our hearty endorsement. In the majority of cases this will probably demand the administration of a general anesthetic, but, even so, the method is based upon the sound surgical principles of doing a perfect operation in the shortest space of time consistent with careful work and with the least shock to the

patient. We have never felt that the forceps operation as so commonly performed, which consists in taking out a bite to-day and another at a future sitting, provided the child will submit to torture a second time, was good surgery, and have wondered at the objections to the more thorough plan. We are also glad to see the "finger-nail method" tabooed. Some form of curette to be worn over the finger may be permissible, but to deliberately wound soft tissues with the nail, knowing the difficulties in the way of sterilizing it, is to assume considerable risk of infection. Furthermore, as Grayson points out, the method is seldom sufficient to eradicate a growth which is of even ordinary size and consistence.

Nearly one-half the book is devoted to Otology, those diseases mainly being considered which have their origin in some abnormal condition of the throat or nose and the general practitioner will find this part especially valuable. These affections are seldom seen by the specialist until they have reached an advanced stage, and the family physician, therefore, has the best opportunity to detect and treat them successfully. He will have here a useful guide in differential diagnosis accompanied by the best directions for treatment.

In the very excellent chapters dealing with suppurative otitis media and its sequelae we regret to see the phrase "laudable pus" used (page 423, top line). Quibbling over a word may not be desirable, particularly in a work of such general excellence, but the word "laudable" is capable of conveying a false security to so many who will be impressed by it that we fear it to be a very dangerous adjective. A more appropriate descriptive word should certainly be found if we would relieve ourselves of all shadow of responsibility for the all too prevalent idea that a purulent flow from the ear is a laudable condition. The danger lies not so much in the use of the word as in its possible misinterpretation.

The appearance of the book cannot be too highly praised; the cover is beautiful, the paper heavy and of fine finish, the type clear and distinct, and the illustrations both appropriate and well executed. Author and publisher are to be thanked and congratulated alike. H. O. R.

A Nurse's Guide for the Operating Room. By Nicholas Senn, M. D., Ph. D., LL. D., C. M., Professor of Surgery, Rush Medical College, etc. Published under the direction of the Sisters of Charity, St. Joseph's Hospital, Chicago. (*Chicago: W. T. Keener & Co., 90 Wabash Avenue, 1902.*)

This manual for the guidance of nurses has been prepared by Dr. Senn to meet the needs which arise in the performance of surgical operations in hospitals and private houses. It is concisely and clearly written and the directions given are explicit, painstaking and valuable. It is true it is primarily written for those who are assisting in Dr. Senn's own operations, and is thus all the more valuable as indicating his practical methods. Some omissions may be mentioned. For example, he does not mention the use of rubber gloves, notwithstanding the almost universal employment of them in America during the past three years. In the disinfection of cat-gut he does not speak of the cumol method, which is probably the most reliable of all forms of catgut disinfection. A chapter on metric data with examples for the change of the metrical system into its equivalents and *vice versa* is an interesting and helpful feature of the book.

The Diseases of Infancy and Childhood. For the use of students and practitioners. By Henry Koplik, M. D., Attending Pediatrist to Mt. Sinai Hospital. (*New York and Philadelphia: Lea Brothers & Co., 1902.*)

After reading this book, meritorious as it is in many respects, one who has been familiar with the excellent work of the author in pediatrics has a feeling of disappointment. To condense into a volume of this size a subject which has grown so large as pediatrics has been a difficult undertaking—and what has been gained in conciseness has been lost in clearness and literary style. The reader can but regret the short, choppy, loosely constructed sentences which are characteristic of many of the chapters. These with many typographical errors give one the impression that the book has been rather hurriedly written and printed.

Unquestionably the best chapters in the book are those on the specific infectious diseases, all of which are treated most satisfactorily.

Considering the great importance of gastro-enteric diseases and infant feeding, one has a right to expect more detail in description of the preparation of food and the management of patients than is found. The author himself confesses that his conclusions on raw milk are not clear but rather confusing. Contrary to the general acceptance he denies that the use of atropine and morphine in such collapsed conditions as cholera infantum is beneficial.

On account of the pain, slowness of absorption, the tendency to extravasation of blood, and its solvent action on the red blood cells he uses subcutaneous injections of salt solution instead, only, however, as a last resort and then in quantities of twenty to thirty cc. twice or three times daily.

The mouths of breast-fed infants, in the author's judgment, are not to be washed, the necessity for this being avoided by careful attention to the mother's nipple; in bottle-fed children the mouth should be washed once daily.

The author considers Babinsky's reflex of no value in children under two years and Kernig's symptom of none under one year.

For congenital syphilis he prefers calomel to inunctions.

His description of lumbar puncture and his conclusions as to the diagnostic value of the fluid are especially clear. He agrees with Lichtheim and Pfaundler, and relies upon the cobweblike funnel shaped coagulum which begins to form in the test tube of fluid from tuberculous meningitis within two hours, and is complete in twenty-four hours.

Throughout, the book shows the author's wide acquaintance with the literature and too, his large personal experience and while as has been said, it is somewhat disappointing in certain particulars, as a whole, it is of great value to both student and practitioner.

The illustrations are numerous, well selected and unusually well reproduced; the type and paper are very good.

The Diseases of Infancy and Childhood. For the use of students and practitioners. By L. Emmet Holt, M. D., LL. D., Professor of Diseases of Children in the College of Physicians and Surgeons, New York. (*New York: D. Appleton & Co., 1902.*)

It is high praise to say that this second edition is all which any person familiar with the first edition might have expected.

Fully conversant with the literature, with a rare hospital and pathological experience and possessing a large and varied private practice, the author is equipped beyond most to write a work on pediatrics from the point of view of student and practitioner. The work is comprehensive but never tiresome; it is thoroughly abreast with recent investigations, and covers the field in its medical aspect. The author combines to an unusual degree the careful observer, the interesting teacher, the progressive practitioner and the facile writer.

In a work of such general merit it is difficult to select any part more worthy of special commendation than another. It may be said, however, that the section on nutrition, including milk and infant feeding and the chapters on diseases of digestion

and the respiratory system, commend themselves particularly because of a carefulness of detail in the description of disease and in the management of cases almost unique in text books.

The author recognizing the scant attention which has been given to pathological changes in very early life, in most works on pathology and how necessary some knowledge of such changes is to a proper appreciation of symptoms and diagnosis has given more space to such description than is usual in clinical works, and has illustrated them by well selected drawings and photographs.

The general arrangement of chapters and grouping of subjects are much the same as in the first edition, but many chapters have been rewritten and enlarged and a number of tables, diagrams, and charts added, which aid materially in the clearness of clinical description.

In conclusion it may be said that since an accurate statement of underlying principles determines the value of a text-book to students, and since practical usefulness is the standard for the general practitioner, this second edition of Holt's work will be found to meet the needs of both to-day in the same satisfactory manner as the first did five years ago.

The work of the publishers in type and in the reproduction of photographs and drawings has been well done and the book presents an attractive appearance.

Atlas and Epitome of Abdominal Hernia. By PRIVATDOCENT DR. GEORG SULTAN, of Gottingen, Edited, with additions, by WILLIAM B. COLEY, M. D., Clinical Lecturer on Surgery, Columbia University (College of Physicians and Surgeons). With 119 illustrations, 36 of them in colors, and 277 pages of text. (*Philadelphia and London: W. B. Saunders & Co., 1902.*) Cloth, $3.00 net.

This is undoubtedly the best brief work on hernia that has yet been published. It is ably written by Sultan whose ideas are thoroughly modern, and carefuly edited by Coley whose experience qualifies him to both edit and supplement such a work.

Both palliative and radical methods of treatment are given due emphasis. The author states that we now regard as a sufficient indication for operation the wish of the patient to be emancipated from his truss and the danger of eventual strangulation; the only questions being whether the operation is contraindicated in the very young, in the very old, or by an enormous size of the hernia.

The illustrations, most of which are original, are numerous, artistic, and instructive. An apparent carelessness in the preparation of the index, so typical of many American text-books, should not pass unnoticed.

The Diagnosis of Surgical Diseases. By E. ALBERT, late Director and Professor of the First Surgical Clinic, University of Vienna. Authorized translation from the 8th enlarged and revised edition by ROBERT T. FRANK, A. M., M. D., with 59 illustrations. (*New York: D. Appleton & Co., 1902.*)

This book of 419 pages is by no means a complete treatise on surgical diagnosis, but does discuss in a very interesting way a large number of the more important purely surgical affections and gives in an entertaining style quite different from the ordinary systematic text-book the process of reasoning by which the surgeon may arrive at a diagnosis. The book has long been considered a classic by Germans both as regards the scientific value of its contents and the style in which it is written. Dr. Frank is to be congratulated that in this translation much of the peculiar charm of the original has been preserved. The book follows closely the style of a clinical lecture but is more systematic than are the lectures of the average teacher of surgery. In some subjects, for example appendicitis, the teachings seem a little antiquated specially to the American student, but for the most part in questions of diagnosis there is far less opportunity for change than in matters pertaining to the treatment of surgical affections. While there are numerous works on medical diagnosis accessible to American readers, books on surgical diagnosis are comparatively few and this volume fills a decided need. We would confidently recommend it as a book which can be read with interest and profit by the student, practitioner or experienced surgeon.

General Paresis. Practical and Clinical. By ROBERT HOWLAND CHASE, A. M., M. D., Physician-in-Chief Friends' Asylum for the Insane, etc. Illustrated. (*Philadelphia: P. Blakiston's Son & Co., 1012 Walnut St., 1902.*)

This book of less than 300 pages contains 18 chapters and an index. It is practically a compilation of the English literature of general paresis, prepared for the guidance of general practitioners who may happen to see early cases. The arrangement of the book is such as to render it a convenient store-house, easily accessible, of clinical facts concerning this disease. The undertaking evinces great industry and a wide reading of current English medical literature.

The illustrations are probably the most valuable feature of the book, as they portray paresis in its different stages. The chapter on treatment gives an excellent resume of various forms of medical treatment. The list of remedies is a long and disappointing one. The book is attractively printed.

A Manual of Instruction in the Principles of Prompt Aid to the Injured, including a chapter on Hygiene and the Drill Regulations for the Hospital Corps, U. S. A. Designed for military and civil use. By ALVAH H. DOTY, M. D., Health Officer of the Port of New York. Fourth edition, revised and enlarged. (*New York: D. Appleton & Co., 1902.*)

This volume is the 4th edition of a work which has been before the public for the past thirteen years. It contains a modicum of anatomy, physiology and hygiene, with clear and forcible directions as to the care of the sick and injured. Directions are given for the control of hemorrhage, the prompt and temporary treatment of burns, fractures and other injuries, the treatment of cases of poisoning and the resuscitation of the drowned. There are also chapters on the disinfection of rooms and on the removal and transportation of the wounded from the battlefield. The book is concise and practical and can be recommended for the instruction of male nurses and orderlies and all other persons who from their occupations are required to give first aid to the injured.

The Principles and Practice of Bandaging. By GWILYM G. DAVIS, M. D., Asst. Professor of Applied Anatomy, University of Pennsylvania. Illustrated from original drawings by the author. (*Philadelphia: P. Blakiston's Son & Co., 1012 Walnut St., 1902.*)

This is an admirable little book on bandaging. The illustrations from original drawings by the author are an excellent feature. An effort is made to simplify the whole subject of bandaging and to eliminate the refinements which have come down to surgeons as a matter of tradition. The table of contents, although full and systematic, does not compensate for the lack of a good alphabetical index. All hand-books of this character should be easily accessible to the reader.

Surgical Principles and Diseases of the Face, Mouth, and Jaws. A Text-Book of the Surgical Principles and Surgical Diseases of the Face, Mouth, and Jaws. For Dental Students. By H. Horace Grant, A. M., M. D., Professor of Surgery and of Clinical Surgery, Hospital College of Medicine, Louisville. Octavo volume of 231 pages, with 68 illustrations. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The author states in his preface that "the pathology of the essential processes of acute surgical diseases is not desired by the student of dentistry during his college days." A few quotations will show how successfully such an "exhaustive analysis" has been avoided in the book. "Forms of the toxins of pathogenic bacteria, rendered less virulent by attenuation, constitute the antitoxic serums used to prevent and cure diseases, as diphtheria and tetanus. Vaccination likewise is in a degree an example" (p. 12). Again, " . . . pus is the result of germs of suppuration, a quarter of a million being required to form a small abscess" (p. 37). The surgeon will be interested to learn that "Lupus is a tubercular germ, sometimes, as in the lupus exedens, of a malignant tendency" (p. 162), and that "Schleich's solution has no special value" (p. 64). The book is well bound and printed, but it can hardly expect a place on the shelves of any thoughtful student.

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STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Reed, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo, with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the Johns Hopkins Press, Baltimore, Maryland.

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GENERAL STATEMENT.

The Medical Department of the Johns Hopkins University was opened for the instruction of students October, 1893. This School of Medicine is an integral and coördinate part of the Johns Hopkins University, and it also derives great advantages from its close affiliation with the Johns Hopkins Hospital. The required period of study for the degree of Doctor of Medicine is four years. The academic year begins on the first Tuesday in October and ends the second Tuesday of June, with short recesses at Christmas and Easter. Men and women are admitted upon the same terms.

In the methods of instruction especial emphasis is laid upon practical work in the Laboratories and in the Dispensary and Wards of the Hospital. While the aim of the School is primarily to train practitioners of medicine and surgery, it is recognized that the medical art should rest upon a suitable preliminary education and upon thorough training in the medical sciences. The first two years of the course are devoted mainly to practical work, combined with demonstrations, recitations and lectures, in the Laboratories of Anatomy, Physiology, Physiological Chemistry, Pharmacology and Toxicology, Pathology and Bacteriology. During the last two years the student is given abundant opportunity for the personal study of cases of disease, his time being spent largely in the Hospital Wards and Dispensary and in the Clinical Laboratories. Especially advantageous for thorough clinical training are the arrangements by which students, divided into groups, engage in practical work in the Dispensary, and throughout the fourth year serve as clinical clerks and surgical dressers in the wards of the Hospital.

REQUIREMENTS FOR ADMISSION.

As candidates for the degree of Doctor of Medicine the school receives:

1. Those who have satisfactorily completed the Chemical-Biological course which leads to the A. B. degree in this university.

2. Graduates of approved colleges or scientific schools who can furnish evidence: (a) That they have acquaintance with Latin and a good reading knowledge of French and German; (b) That they have such knowledge of physics, chemistry, and biology as is imparted by the regular minor courses given in these subjects in this university.

The phrase "a minor course," as here employed, means a course that requires a year for its completion. In physics, four class-room exercises and three hours a week in the laboratory are required; in chemistry and biology, four class-room exercises and five hours a week in the laboratory in each subject.

3. Those who give evidence by examination that they possess the general education implied by a degree in arts or in science from an approved college or scientific school, and the knowledge of French, German, Latin, physics, chemistry, and biology above indicated.

Applicants for admission will receive blanks to be filled out relating to their previous courses of study.

They are required to furnish certificates from officers of the college or scientific schools where they have studied, as to the courses pursued in physics, chemistry and biology. If such certificates are satisfactory, no examination in these subjects will be required from those who possess a degree in arts or science from an approved college or scientific school.

Hearers and special workers, not candidates for a degree, will be received at the discretion of the Faculty.

ADMISSION TO ADVANCED STANDING.

Applicants for admission to advanced standing must furnish evidence (1) that the foregoing terms of admission as regards preliminary training have been fulfilled, (2) that courses equivalent in kind and amount to those given here, preceding that year of the course for admission to which application is made, have been satisfactorily completed, and (3) must pass examinations at the beginning of the session in October in all the subjects that have been already pursued by the class to which admission is sought. Certificates of standing elsewhere cannot be accepted in place of these examinations.

SPECIAL COURSES FOR GRADUATES IN MEDICINE.

Since the opening of the Johns Hopkins Hospital in 1889, courses of instruction have been offered to graduates in medicine. The attendance upon these courses has steadily increased with each succeeding year and indicates gratifying appreciation of the special advantages here afforded. The special courses of instruction for graduates in medicine are now given annually during the months of April, May and June. During April there are courses in Normal Histology and Gross Anatomy. In May and June courses are offered in Pathology, Bacteriology, Clinical Microscopy, General Medicine, Surgery, Gynecology, Obstetrics, Dermatology, Diseases of Children, Diseases of the Nervous System, Genito-Urinary Diseases, Laryngology and Rhinology, and Ophthalmology and Otology. The instruction is intended to meet the requirements of practitioners of medicine, and is almost wholly of a practical character. It includes laboratory courses, demonstrations, bedside teaching, and clinical instruction in the wards, dispensary, amphitheatre, and operating-rooms of the Hospital. These courses are open to those who have taken a medical degree and who give evidence satisfactory to the several instructors that they are prepared to profit by the opportunities here offered. The number of students who can be accommodated in some of the practical courses is necessarily limited. For these the places are assigned according to the date of application.

The Annual Announcement and Catalogue will be sent upon application. Inquiries should be addressed to the

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THE RÔLE OF THE TOXINS IN INFLAMMATIONS OF THE EYE.[1]

BEING AN ESSAY TO WHICH WAS AWARDED THE BOYLSTON PRIZE.

By Robert L. Randolph, M. D.,

Associate Professor of Ophthalmology and Otology, Johns Hopkins University.

(*From the Pathological Laboratory of the Johns Hopkins University.*)

The investigations of Sattler, von Michel, Fick, Weeks, and others have shown that bacteria are constantly present in the normal conjunctival sac, and that these bacteria are not always harmless. It is no uncommon thing to find either the micrococcus lanceolatus or the staphylococcus aureus in a conjunctiva which is, clinically speaking, normal, while Randolph's[1] investigations prove that the micrococcus epidermidis albus (Welch) is an almost constant inhabitant of the normal conjunctival sac.

The researches of Uhthoff and Axenfeld[2] show that the pneumococcus is the most important etiological factor in serpent ulcer of the cornea, and this affection is commonly spoken of nowadays as "pneumococcus ulcer." Such an

[1] This also appeared in the American Journal of the Medical Sciences for November, 1902.

ulcer usually presupposes two conditions—first, a break in the corneal epithelium; and, second, the presence of the pneumococcus, which, as I have said, is often found in the conjunctival sac.

And when I speak of the staphylococcus aureus I am reminded of the records of many unsuccessful cataract operations where failure was traced to the presence of this organism, which there were strong reasons for believing was not introduced into the conjunctiva through blunders in modern operative technique.

The micrococcus epidermidis albus has but slight pathogenic properties, and to this we owe it in large measure that so many eyes survive serious wounds, for this organism has been demonstrated as being generally present in the normal conjunctival sac. Abundance of evidence, then, is at hand to show that the healthy conjunctiva, like the healthy vagina and the healthy intestine, probably contains bacteria at all times.

On the other hand, we know that most inflammations of the conjunctiva are caused by the growth and multiplication, either in the conjunctiva or on its surface, of special bacteria. Trachoma, vernal catarrh, and phlyctenular conjunctivitis have all been thought to originate in special bacteria, and efforts to solve these problems have brought forth much that is valuable, but nothing definite. Personally, I feel quite certain of the parasitic origin of trachoma, but I doubt whether it can be shown that either of the other diseases has its own bacterium. But when we speak of serpent ulcer, acute contagious conjunctivitis or "pink eye," gonorrhœal ophthalmia, and subacute or chronic conjunctivitis we no longer walk on debatable ground, but are in territory whose landmarks are well established, and at once we remember that serpent ulcer is caused by Fraenkel's pneumococcus, "pink eye" by the Koch-Weeks bacillus, gonorrhœal ophthalmia by the gonococcus of Neisser, and subacute or chronic conjunctivitis by the diplobacillus of Morax-Axenfeld.

These are but a few examples which show the relationship which bacteria bear to inflammations of the eye, and as ophthalmic literature of the past ten years is full of proof of this fact, it is unnecessary for me to multiply evidence of this character.

How do these, or in fact any organisms, produce inflammation of the conjunctiva? Either by acting as a foreign body—in other words, by irritating the conjunctiva—or by producing soluble substances, which in their turn act upon the cellular elements of the tissues. It is easy to see that there are decided objections to accepting the view that when organisms produce inflammation of the conjunctiva they do so by acting as foreign bodies, for in that case all organisms would be on pretty much the same footing when present in the conjunctiva, and they would always produce more or less irritation. Then, again, it would be difficult to explain how certain organisms produce more intense reaction than others, for, so far at least as size is concerned, there is no significant difference in the bacteria which we usually find in the conjunctival sac; and we know, too, that in the case of the very organisms which I have mentioned (as causing specific inflammations of the eye) they must have been a certain length of time in contact with the surface of the conjunctiva before the clinical symptoms of inflammation are visible. The mechanical hypothesis, then, if I may so term it, can easily be shaken; while the other hypothesis—the gist of which is that inflammation results from the action of the poisonous products of the organisms upon the cells of the eye—rests upon a much firmer foundation.

It is evident, however, that we are beset with many difficulties when we attempt to prove this experimentally, for we know that the Koch-Weeks bacillus, the gonococcus, and the diphtheria bacillus are peculiar to man, and that these bacteria will produce little or no reaction in the conjunctiva of animals, because the medium is not the proper one for their growth. Heller[3] inoculated the conjunctiva of the newborn rabbit with a gonococcus culture, and claims to have found the organism living in the purulent secretion of the conjunctival sac twenty-four hours after the inoculation. I have repeatedly tried to get a reaction by introducing this organism into the conjunctival sac of the rabbit, but the result of the experiment was always negative, and even when a slight wound of the conjunctiva was made the reaction was very doubtful.

Morax and Elmassian[4] have repeated Heller's experiments, and have occasionally succeeded in getting his results. In order to get the desired reaction one must secure a very virulent race of gonococci—that is to say, the organism must have figured in a very severe case of gonorrhœa. One must introduce as much as possible of the culture (of twenty-four hours' growth) into the conjunctiva. The lids must then be either occluded with collodion or a thread passed through them, and this condition maintained until the next day. But even with conditions so favorable Morax and Elmassian failed to produce an inflammation which was comparable to the gonorrhœal ophthalmia of the human being; and as regards the organism itself, cover-slips gave most unsatisfactory information, while nothing grew from cultures made from the inoculated conjunctival sac.

From all this it would seem clear that it is impossible to produce with the gonococcus in the rabbit's conjunctiva a reaction similar to genuine gonorrhœal ophthalmia, and the same observation holds good for the diphtheria bacillus, the Morax-Axenfeld diplobacillus, and the Koch-Weeks bacillus.

Infectious bacteria produce inflammation in the conjunctiva not only by growing and multiplying in this region, but, in addition, by producing substances called toxins. Toxins, according to Armand Gautier,[5] are chemical substances susceptible of filtration, precipitation, and resolution. They are usually complex, and made up of an alkaloidal material and a nitrogenous substance, which is very active. It must, however, be said, that we have no precise information as to the chemical nature of bacterial

toxins. They are chemically undefined substances which at present can be recognized only by biological tests; these relating especially to their specific effects upon living organisms, including the capacity to lead to the production within the animal body of specific antitoxins.

Inasmuch as we have no multiplication of bacteria, and consequently no formation of toxins, we have an explanation for the absence of inflammation when the bacteria just mentioned are introduced into the conjunctival sac of the rabbit. But when we do get inflammation—as, for instance, when these same bacteria under certain conditions find their way into the human conjunctival sac—what part do the toxins play in causing this inflammation? This is the problem under consideration.

The question as to the part played by the toxins in inflammations of the eye is one which has not led to much discussion, still less to original research. The only experimental studies which have been made on the subject are by Bardelli,[6] Druault and Petit,[7] Henri Coppez,[8] and Morax and Elmassian.[4] The first two communications are very brief, and while suggestive, they cover too little ground to rank with the work either of Coppez or of Morax and Elmassian.

The contribution of Coppez contains an account of experiments made with a view of ascertaining more particularly the manner in which the toxins secreted in the conjunctival sac act upon the cornea. One can take as a typical disease diphtheria of the conjunctiva. He finds that the diphtheritic toxin acts upon the anterior surface of the cornea. The epithelium offers a certain resistance to the action of the toxin, but when the former breaks down the cornea undergoes rapid changes. Anything now which produces a lesion of the anterior surface of the cornea would aggravate the trouble. For example, the epithelium can be injured by the very act of making applications to the eye in the course of the treatment; the constant brushing of the cornea by the false membrane on the upper lid can easily produce a disturbance in the corneal epithelium; and, finally, the action of the toxin itself upon the epithelium, which is often macerated after about forty-eight hours.

Contrary to the results of Gosetti and Iona,[9] the experiments of Coppez demonstrate that the tears have no antiseptic influence upon the diphtheria bacillus. The toxin of diphtheria has a real action upon the cornea.

The streptococcus toxin has very little action upon the cornea, and Coppez has shown that many of the phenomena observed by Bardelli in his experiments were due not to the toxins, but either to the bouillon or to the dead bodies of the microbes, or possibly to the substances which were added to the bouillon in order to kill the microbes. The pneumococcus toxin has also very little effect upon the cornea; and this is due not only, as Druault and Petit believe, to the peculiar or special resistance which the corneal epithelium offers to this toxin, but, above all, to the feebleness of the latter.

The toxins of the staphylococci, the effects of which have also been studied by Soloview and Molodorosky,[10] reproduce on a small scale pretty much the same lesions as the staphylococci themselves.

The most valuable study, however, up to 1899, was made by Morax and Elmassian,[4] and the results of their experiments were embodied in a communication made to the Ninth International Ophthalmological Congress at Utrecht, in August, 1899. These observers instilled into the rabbit's conjunctival sac the toxins of the gonococcus, of the Koch-Weeks bacillus, of the Morax-Axenfeld diplobacillus, and of the staphylococcus. Their work is far more comprehensive than any previous communication upon the subject. They were able to produce in rabbits a conjunctivitis by instilling into the conjunctival sac either a suspension of the dead organisms or the filtrate of these cultures. Of course, these organisms do not multiply in the conjunctival sac of the rabbit; and it is for this reason, as has been stated, that we only get negative results when we try to produce a conjunctivitis in this animal by inoculating with exudates or infectious material taken from the human conjunctiva.

As regards the toxins of the organisms just mentioned, the experiments of Morax and Elmassian show that the ocular mucous membrane of the rabbit reacts under the influence of these toxins very much as does the human conjunctiva. These toxins do not seem to have much penetrating power, as prolonged contact is necessary in order to get the characteristic reaction. The reaction is not immediate, for there is always an interval of two or three hours between the commencement of the instillation and the moment of the appearance of the reactional symptoms. The different toxins do not seem to be characterized by the same kind of reactional symptoms. The reaction following the instillation of the gonococcus toxin was a little more persistent than that of either the Koch-Weeks bacillus or of the diplobacillus, while the toxins of none of these organisms produced so intense a reaction as the diphtheria toxin. These observers made thirty-eight experiments.

In October, 1899, a few weeks before I had seen either the work of Coppez or of Morax and Elmassian, I had commenced an experimental study along these lines. In a work of this character one would naturally select the toxins of those organisms which were known to be concerned in the production of certain ocular inflammations, as, for instance, the gonococcus, the diphtheria bacillus, and the pneumococcus. In addition to these organisms I experimented with the toxins of the staphylococcus aureus, micrococcus epidermidis albus, streptococcus pyogenes, bacillus coli communis, and bacillus xerosis, each of which, with the exception of the micrococcus epidermidis albus, has been placed on record at various times as being more or less concerned in producing inflammation of the eye in some form or other. For example, the staphylococcus aureus is related to a number of inflammatory conditions of the cornea and conjunctiva, being found on the margins of the lids in blepharitis and phlyctenular conjunctivitis. This organism is often found in blennorrhœa of the lacrymal

sac, and in mixed infections in most corneal ulcers except in the so-called "pneumococcus ulcer" (serpent ulcer).

The micrococcus epidermidis albus is a less pathogenic organism than the preceding one; and while I can find no record which would indicate that it was the principal agent in an inflammation of the eye, I am of the opinion that under suitable conditions it is pathogenic, and that in many of our more common conjunctival and corneal troubles, to say nothing of post-operative inflammation, this organism plays a part.

The streptococcus pyogenes is sometimes the cause of corneal ulcer, and it is also concerned in various suppurative processes in the eye. This organism is not infrequently present in purulent dacryocystitis, either alone or mixed with other bacteria, and there is a form of membranous conjunctivitis generally seen in children, and which is caused by the streptococcus, and known as streptococcus diphtheria of the conjunctiva.

The bacillus coli communis is on record as having caused panophthalmitis.[11] Groenouw[12] has observed this organism in catarrhal conjunctivitis of the newborn.

The xerosis bacillus, like the micrococcus epidermidis albus, is often found in the normal conjunctival sac, and, like the latter organism, probably plays a part in many of the inflammations in this locality.

The toxins were obtained by filtration, though sometimes the dead cultures were used.

I have divided this work into four parts: Part I. The effect produced by toxins when they are instilled into the conjunctival sac. Part II. The effect produced by toxins when they are injected into the conjunctiva. Part III. The effect produced by toxins when they are injected into the anterior chamber. Part IV. The bacteriology of the normal conjunctiva of the rabbit, based upon an examination of forty-seven cases.

Part I. The Effect Produced by Toxins when they are Instilled into the Conjunctival Sac.

Technique.—The filtrate was obtained as follows: An inoculation was made from a pure culture of the organism into an Erlenmeyer flask which contained bouillon free of sugar. It is necessary for the bouillon to be free of sugar, as the presence of the latter has been shown to inhibit more or less the production of toxins. The inoculated bouillon is placed in the incubator and allowed to remain there for at least two weeks.

It is well that this amount of time be allowed for the growth of the organisms, for in this way we obtain a filtrate which is much richer in the so-called products of these organisms.

Cultures and cover-slips are then made from this mixture to see whether the original organism is present in pure culture. If these two tests result satisfactorily the fluid is passed through a Pasteur filter into a sterile Erlenmeyer flask. Inoculations are made from this filtrate on "slant agar," and both the tube and the filtrate are placed in the incubator. If at the end of three days there is no growth in the agar, and the filtrate has remained perfectly clear, the evidence is sufficiently conclusive that the filtrate contains no bacteria.

The animal is wrapped up tightly in a towel, which is carried up well around the neck, and in this position the rabbit can be kept absolutely quiet.

When the experiment lasted longer than two hours the animal was allowed to move about on a large table which was free of obstructions, and here the chances of infection were slight as compared to the chances of infection when in either a large cage or in the enclosure with the other animals.

A long sterilized dropper was used to instil the filtrate into the conjunctival sac, and when it was not being used it was kept in a vessel of sterile water.

In those experiments which lasted for two hours and less the conjunctival sac was kept full of the filtrate all the time. When the animal was allowed to run around on the table the instillations were made every few minutes, and in this way the experiment could be started at 8.30 in the morning, and, with the exception of the hour between 12 o'clock and 1 P. M., kept up until 5.30 in the afternoon. None of the experiments lasted longer than eight hours, and the shortest time was fifteen minutes. The animal was kept under the closest observation for two days after the experiment, and anything approaching a reaction was noted. Such, then, was the technique of the experiments performed in this division of the work.

Gonococcus Toxin.—According to Christmas,[13] the gonococcus toxin is found partly in the body of the organism and partly dissolved in the culture medium. It is albuminoid in character, soluble in glycerin, precipitated by strong alcohol, and is destroyed by any considerable exposure to a high temperature. It is possible to produce immunity in animals by inoculating with increasing doses. Wassermann[14] is of the opinion that the toxin is confined to the body of the organism, and that no toxic products are found in the culture medium. He thinks that feeble traces of a toxin in the medium indicate that this toxin has diffused from the dead bodies of the bacteria. He was unable to produce immunity in animals.

Nicolaysen[15] found that the body of the gonococcus contained a toxin which in small doses would kill a mouse, but his filtered cultures appeared to be inert.

Laitinen[16] found only slight evidence of a toxin in the body of the organism. He holds that the filtered culture contains no toxic substance; at any rate, it is so feeble as not to be distinguishable in its effects from those of the culture medium.

Schaeffer[17] seems to be the only one besides Christmas who obtained toxic cultures. He found that the injection of cultures freed of the organisms into the human urethra produced an acute inflammation accompanied with a purulent discharge. He does not seem to have studied the effect of this toxin upon animals. I may add that the inflammatory reaction following the injection of the dead organ-

isms into the urethra has been studied by Panichi[18] and by Scholtz.[19]

It will be seen from this that several investigators failed to get cultures which contained a soluble toxin. Christmas says that this is due to the fact that defective media were employed, and he has shown that slight differences in the composition of the medium and slight deviations in temperature are sufficient to render a culture atoxic.

The observations of Christmas are fully borne out by my experiments, and I am convinced of the existence of a toxin in the filtrate from a gonococcus culture. This fact is brought out very forcibly in the experiments where the filtrate was injected into the conjunctiva. (Part II.)

I stated that the dead cultures of the organisms were used in only a few instances, and in such cases the growth was always on "slant agar" (two parts plain sugar and one part hydrocele fluid). When the growth was eight days old its surface was covered with about an inch of chloroform, which was not poured off for twelve hours. Six hours later, when every trace of the chloroform in the tube had evaporated, the growth was scraped off and mixed up in a test-tube with sterile water or with sterile bouillon. When the filtrate was used the culture medium consisted of one part bouillon and two parts hydrocele fluid.

Case I.—White rabbit. Instillations of dead cultures mixed with sterile bouillon into the conjunctival sac of both eyes. This was kept up for fifteen minutes, during all of which time the conjunctival sacs were more or less full of the bouillon. *No reaction.*

Case II.—White and gray rabbit. Both eyes. Instillations lasted for one hour. *No reaction.*

Case III.—White and black rabbit. Instillations lasted for one and a half hours. *No reaction.*

Case IV.—White rabbit. Instilled filtrate of gonococcus culture into right eye continuously for two hours. *No reaction.*

Case V.—Same rabbit. Instilled filtrate into left eye for three hours. *No reaction.*

Cases VI and VII.—Gray rabbit. Here the instillations lasted for five hours, at the end of which time there was decided ocular and palpebral congestion. The instillations in this case were kept up for seven hours, and at the end of this time there was conjunctivitis and slight mucopurulent discharge. A repetition of this experiment in the other eye gave a *negative result.*

Case VIII.—Gray rabbit. Instilled dead organisms suspended in bouillon for eight hours into right eye. *No reaction.*

At first sight it would appear to be possible to cause a reaction with the gonococcus toxin if the instillations were sufficiently prolonged; but I was unable to repeat this result, and I am led to think that other causes must have cooperated to produce the conjunctivitis. Very probably a tear was made in the conjunctiva during the instillations. It will be observed in the experiments immediately following this one that the instillations were kept up for the same length of time, but with negative results. (See last half of Case VII and also Case VIII.)

Staphylococcus Aureus Toxin.—It will be remembered that the statement was made that in inflammations of the eye this organism was generally found associated with other organisms, and that it occurred in such affections as phlyctenular conjunctivitis, blennorrhœa of the lacrymal sac, and in mixed infections of the cornea. I have never met with a conjunctivitis where there was reason to believe that this organism by itself caused the inflammation.

It has been shown by van de Velde,[20] Kraus,[21] von Lingelsheim,[22] and Neisser and Wechsberg[23] that a soluble toxin —the so-called staphylo-toxin—is secreted by the pyogenic staphylococci, the most interesting property of this toxin being its power to dissolve red and white blood corpuscles.

Case I.—Gray rabbit. Instillations into the right eye for fifteen minutes, during which time the toxin was constantly in contact with the conjunctiva. *No reaction.*

Case II.—Black and white rabbit. Right eye. Instillations lasted for one hour, and during this time the filtrate was continuously in contact with the conjunctiva. *No reaction.*

Case III.—White and gray rabbit. Right eye. Here the instillations were kept up for two hours, and with absolutely *no reactional symptoms.*

Case IV.—Same rabbit. Left eye. Instillations kept up for five hours. *No reaction.*

Case V.—Black and white rabbit. Left eye. Instillations continued for eight hours. *No reaction.*

Case VI.—Gray rabbit. Dead organisms suspended in sterile bouillon. Instillations kept up for eight hours. *No reaction.*

It will be seen, then, from this series of experiments that the instillation of the staphylococcus filtrate into the conjunctival sac, even when the instillations are kept up for eight hours, is followed by no reaction.

Diphtheria Toxin.—I need not recall the fact that the etiology of probably the gravest of conjunctival affections (diphtheritic conjunctivitis) is bound up in the Klebs-Loeffler bacillus. The sugar-free bouillon, in which medium all of my bacteria were cultivated, is according to Spronck and Theobald Smith, a particularly suitable medium for the production of the diphtheria toxin.

Case I.—White rabbit. Right eye. The conjunctival sac was practically full of the filtrate for fifteen minutes. *No reaction.*

Case II.—Left eye of the same rabbit. The instillations were kept up for one hour, with *no reaction.*

Case III.—White and gray rabbit. Right eye. Instillations were kept up for two hours. *No reaction.*

Case IV.—Black rabbit. Right eye. The instillations were kept up for five hours. *No reaction.*

Case V.—Same rabbit. Left eye. Instillations continued for eight hours, with *no reaction.*

Case VI.—Gray rabbit. Right eye. Instillations of dead organisms suspended in sterile bouillon for eight hours. *No reaction.*

Streptococcus Toxin.—Case I.—Instillations for half an hour into the right eye of a white and black rabbit. During all this time the filtrate was in contact with the conjunctiva. *No reaction.*

Case II.—Same rabbit. Instillations for two hours into the left eye. *No reaction.*

Case III.—White rabbit. Right eye. Instillations for three hours, with absolutely *no reaction.*

Case IV.—Same rabbit. Instillations for four hours into the left eye, with *no reaction.*

Case V.—Gray rabbit. Right eye. Instillations for five hours. *No reaction.*

I cannot say that I was surprised at the results of the experiments in this series, for we know that subcutaneous injections of the organisms into rabbits and mice are, as a rule, without either local or general manifestations of importance. The organism is not particularly pathogenic for animals.

Bacillus Coli Communis Toxin.—This is another organism which is not supposed to possess a soluble toxin, and which in this respect resembles the gonococcus and the pyogenic cocci. It may be interesting to recall a very recent communication by Victor C. Vaughan,[24] of Ann Arbor. This observer in his study of the bacterial toxins devoted a good deal of time to the bacillus coli communis. He finds that the toxin is contained within the cell, from which it does not, at least under ordinary circumstances, diffuse into the culture medium, and that it is not extracted from the cell by alcohol, by ether, or by dilute alkalies. The unbroken germs may be heated to a high temperature with water without destruction of the toxin, and the same result follows boiling with a 0.2 per cent aqueous solution of hydrochloric acid; but when the acid is increased from 1 to 5 per cent the cell wall is broken up and the toxicity lessened, but not destroyed.

The toxin separated from the cell wall by digestion of the latter with hydrochloric acid and pepsin is markedly active.

It will be remembered that this organism has been discovered in pure culture in a case of panophthalmitis, and that several observers report its occurrence in unusual forms of conjunctivitis.

Case I.—Gray rabbit. Right eye. Instillations lasted for fifteen minutes, and the contact was constant. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for one hour. *No reaction.*

Case III.—Black and white rabbit. Instillations for two hours into the right eye, and during this time the contact of the filtrate with the conjunctiva was constant. *No reaction.*

Case IV.—Same rabbit. Left eye. Instillations kept up five hours. *No reaction.*

Case V.—Left eye of rabbit used in Case I. Instillations kept up for eight hours. *No reaction.*

A negative result, then, was obtained in every case in this series. Even when the instillations are kept up practically all day the conjunctiva gives no evidence of inflammation.

Pneumococcus Toxin.—Case I.—White rabbit. Right eye. Instillations kept up for fifteen minutes. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for one hour, with *no reaction.*

Case III.—Black rabbit. Right eye. Instillations for three hours. Absolutely *no sign of reaction.*

Case IV.—Same rabbit. Left eye. Instillations kept up for five hours, with the *same result as in Case III.*

Micrococcus Epidermidis Albus Toxin.—This organism has been found by a number of observers in the normal conjunctiva, and by Randolph[1] eighty-eight times out of a hundred individuals whose conjunctivæ were examined.

Case I.—White rabbit. Right eye. Instillations for one hour, during which time the contact was constant. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for two hours. *No reaction.*

Case III.—Black and white rabbit. Instillations into both eyes for three hours. *No reaction.*

Case IV.—Same rabbit. Instillations into right eye for seven hours. *No reaction.*

As might have been expected from the results obtained in the preceding series, I was unable to get a conjunctivitis by prolonged instillations with the filtrate of this organism.

Xerosis Bacillus Toxin.—This organism, which morphologically is so much like the diphtheria bacillus, is frequently found in the normal conjunctiva, and, like the white skin coccus, is no doubt concerned in many of the more common external eye inflammations.

Case I.—Right eye. Instillations for one hour, during which time the filtrate was in constant contact with the conjunctiva. *No reaction.*

Case II.—Same rabbit. Left eye. Instillations for two hours. *No reaction.*

Case III.—White and gray rabbit. Instillations for four hours into right eye. *No reaction.*

Case IV.—Same rabbit. Left eye. Instillations for five hours. *No reaction.*

It will be seen that forty experiments were performed in this part of the work. In many instances the filtrate was kept in constant contact with the conjunctiva for hours, and only once did I succeed in exciting a conjunctivitis (Case I, p. 53); and I think the interpretation which I gave of this case is probably the proper one—an interpretation which is strengthened by the uniformly negative results obtained in the other thirty-nine cases.

With the exception, then, of this case, the results of the instillations of the filtrates into the conjunctival sac are directly opposed to the results which were obtained by Morax and Elmassian.

Part II. The Effect Produced by Toxins when they are Injected into the Conjunctiva.

There is probably no part of the body which is as able to fight with infectious bacteria as the eye. When we consider how frequently the eyeball is wounded not only by accidents, but also by operative measures, and how comparatively seldom pathogenic infection results, we are forced to the conclusion that the eye must enjoy immunity to a high degree. This immunity or resistance to disease is partly accounted for, no doubt, by the exceptional activity of the leucocytes of the eye. This activity is remarkable in the case of the rabbit's eye, in which animal a considerable wound of the cornea will in twenty-four or forty-eight hours have vanished and left hardly a trace.

In our daily practice we often see the same thing to a less marked degree, and it suggests that the strength of the eye lies not only in the peculiar activity of its leucocytes, but also in the properties of its fluids, which are probably to some extent antibacterial. I need not bring forward evidence to show how much happier have been the issues from operations upon the eye since the advent of Listerism and of all that this word means. That goes without saying, but I think I am quite safe in saying that Listerism found no part of the body so well equipped to take care of its bacteria as the eye. While the mortality (if I may use the word) is less nowadays, the difference in this respect is much less startling than it is in the other fields of surgery.

It is perfectly clear from a study of the foregoing experiments that the rabbit's eye is quite able to withstand the harmful effects of the instillation of toxins upon its surface, no matter if these installations are kept up practically all day. The question is, can this immunity of the eye nullify the effects of these toxins when they are injected into or have gained a foothold in the tissues?

Technique.—The syringe and fixation forceps were boiled five minutes. The eye of the rabbit was anæsthetized with holocaine. The animal was always wrapped in a towel, as in the first series of experiments, in order to keep it immovable. The operation was apparently painless.

In the first place, the conjunctivae of five eyes were injected with sterile bouillon, to see whether any reaction could be produced by the medium. Varying quantities were injected, up to as much as a syringeful.

With the exception of one case in which there was some difficulty in penetrating the conjunctiva, and where there was, in consequence, bruising of the latter, there was no reaction. In the case mentioned it was noticed that the syringe leaked. It was withdrawn, and on inserting it again the conjunctiva was torn.



Fig. 1. Section from the normal conjunctiva of the rabbit. (Zeiss, oc. 4; obj. a a. Enlarged 90 times.) *a.* Epithelial layer. *b.* Connective-tissue layer.

I always endeavored to make the injection at one point in the conjunctiva, which at this location at once puffed up and looked like a big blister.

The operations were performed in the afternoon, and the eyes were examined the next day at the same time.

There was no particular point selected for the injection, though usually it was made above the cornea, at about half an inch from the margin of the latter.

Gonococcus Toxin.—Case I.—Gray rabbit. Injected ten drops of filtrate into the conjunctiva of the right eye, and into the conjunctiva of the left eye the same quantity of sterile bouillon. The next day there was intense reaction in the right eye and no reaction in the other eye.

Case II.—Gray rabbit. Right eye. Injected eight drops into the conjunctiva. The next day there was marked con-

gestion of the upper half of the eyeball, much more intense at the point of penetration.

Case III.—White and black rabbit. Right eye. Injected five drops of the filtrate. Conjunctivitis possibly not so marked as in either of the last cases.

Case IV. Same rabbit. Injected three drops of the filtrate. The next day a slight redness near point of injection, covering about a fourth of the globe.

Diphtheria Toxin.—Case I.—White rabbit. Injected ten drops of filtrate into the conjunctiva of the right eye and ten drops of sterile bouillon into the left. At the end of twenty-four hours there was intense reaction in the right



Fig. 2.—Conjunctivitis. Gonococcus toxin. Case I. (Zeiss, oc. 4; obj. a a. Enlarged 90 times.) *a* Connective-tissue layer. *b*. Distended blood-vessels. *c*. Epithelial layer. *d*. Large exudate resting upon the epithelial layer. *e*. Area in connective-tissue layer crammed with leucocytes and round cells.

eye. There was an almost typical picture of diphtheritic conjunctivitis. The swelling of the lids was so great that the animal could not open its eye. When the lids were forcibly opened there was a welling up of a purulent discharge, and there was a strong suggestion of a membrane on the upper lid. The cornea was rather dull. The left eye, into which ten drops of sterile bouillon had been injected, showed no reaction. This was the only case in which I obtained a reaction which resembled the picture seen in the human being. The same filtrate was used for an instillation experiment and the instillations kept up nearly all day, but with negative result.

Welch and Flexner have shown that the poison producing the false membrane is an intracellular one, and not the soluble toxin, so that a definite pseudomembrane is not to be expected after injecting the latter alone.

Case II.—White rabbit. Right eye. Injected eight drops of the filtrate. The next day there was marked conjunctivitis, with possibly a little excess of secretion.

Case III.—Same rabbit. One week later. Injected into left eye six drops of filtrate. Twenty-four hours later there was conjunctivitis which did not differ materially from the condition which was seen in Case II.

Case IV.—White and black rabbit. Left eye. Injected three drops of filtrate. The next day there was conjunctivitis which consisted in simple congestion of the upper half of the eyeball, with no discharge.

Pneumococcus Toxin.—Case I.—White rabbit. Injected fifteen drops of filtrate into the conjunctiva of the right



Fig. 3.—Conjunctivitis. Intense hemorrhagic inflammation. Diphtheria toxin. Case I. (Zeiss, obj. D D; oc. 4; enlarged 420 times.) *a*. Connective-tissue layer which is very œdematous. Red blood corpuscles and polynuclear leucocytes may be seen everywhere throughout this section. *b*. Engorged blood-vessels.

eye and the same quantity of sterile bouillon into the conjunctiva of the left eye. The next day the right eye showed marked conjunctivitis which extended over the entire eyeball, while the result of the injection in the left eye was negative.

Case II.—Injected left eye of the same rabbit. Eight drops of filtrate were used. Twenty-four hours later conjunctivitis, with no increased secretion.

Case III.—White and black rabbit. Injected six drops of filtrate into the conjunctiva. The next day there was conjunctivitis which did not differ materially from the condition in the preceding case.

Case IV.—Same rabbit. Left eye. Injected three drops

of filtrate. The next day there was redness of the conjunctiva near the point of the injection, but the inflammation in this case was very localized.

Streptococcus Toxin.—CASE I.—Injected fifteen drops of filtrate into the conjunctiva of the right eye and the same quantity of sterile bouillon into the conjunctiva of the left eye. Next day pronounced conjunctivitis, which was uniformly distributed. The left eye showed no change.

CASE II.—Same rabbit. Few days later. Injected ten drops of filtrate into left eye. Conjunctivitis the next day. Possibly somewhat less marked than in the preceding case.

Case III.—White rabbit. Injected ten drops of filtrate into right eye. The next day conjunctivitis, which was pretty uniformly distributed.

CASE IV.—Same rabbit. Left eye. Injected eight drops of filtrate. Next day there was conjunctivitis which differed very little from the reaction seen in Case III.

CASE V.—White and black rabbit. Right eye. Injected five drops of filtrate. Next day there was slight conjunctivitis.

Staphylococcus Aureus Toxin.—CASE I.—White rabbit. Injected into the right eye fifteen drops of filtrate. The next day there was marked conjunctivitis which differed in no respect from the conjunctivitis which was seen in Case I in the preceding series. The other eye, into which the same quantity of sterile bouillon was injected, showed no reaction.

CASE II.—White and gray rabbit. Injected ten drops of filtrate into right eye and the same quantity of sterile bouillon into the left eye. The next day the right eye showed conjunctivitis. There was also some congestion of the left eye, but I am disposed to attribute the reaction in this eye either to bruising of the tissues or to some accidental infection which occurred after the experiment.

CASE III.—Same rabbit. One week later. Injected eight drops of filtrate into left eye. The next day there was conjunctivitis, but not nearly so marked as in Case I.

CASE IV.—White and black rabbit. Right eye. Injected five drops into the conjunctiva of this eye and five drops of sterile bouillon into the conjunctiva of the left eye. Slight conjunctivitis in the right eye and no reaction in the left eye.

Bacillus Coli Communis Toxin.—CASE I.—Black rabbit. Injected fifteen drops of filtrate into the right eye and the same quantity of sterile bouillon into the left. The next day there was almost as intense a reaction in the right eye as was seen when ten drops of the gonococcus and diphtheria toxins were used. The left eye showed no reaction.

CASE II.—Same rabbit. Left eye. Injected ten drops into the conjunctiva. The next day there was quite a marked conjunctivitis.

CASE III.—White and black rabbit. Right eye. Injected eight drops of filtrate. The next day there was conjunctivitis not differing materially from what was seen in the preceding case.

CASE IV.—White rabbit. Injected three drops into the conjunctiva of left eye. The next day there was slight congestion in the upper half of the eyeball, more marked near the point of the injection.

Xerosis Bacillus Toxin.—CASE I.—White rabbit. Injected fifteen drops of filtrate into the right eye and fifteen drops of sterile bouillon into the left. The next day there was marked conjunctivitis in the right eye and no reaction in the left eye.

CASE II.—Same rabbit. Left eye, a few days later. Ten drops of filtrate injected. Conjunctivitis, but less marked than in the preceding case.

CASE III.—White rabbit. Injected into the right eye five drops of filtrate. Next day there was conjunctivitis not differing materially from Case II.

Micrococcus Epidermidis Albus Toxin.—Three experiments were performed in this series, and they resulted practically as did those in which the xerosis bacillus was employed.

It will be seen that thirty-one experiments were performed in this series, with a positive result in every case—a marked contrast to the results which were obtained in Part I.

I have more than once recalled the fact that several of the organisms with which I have experimented are not supposed to produce soluble toxins. The uniformly positive results which were obtained in Part II suggested that possibly the effect produced was due to the presence in the filtrate of some of the so-called bacterio-proteins described by Buchner, and which are distinctly irritating. These products are incorporated in the substance of the bacterial cells, and are set free especially from degenerated or dead bacteria. The older a culture the greater the number of dead or degenerated bacteria which it contains. It is evident, then, that these bacterio-proteins are more abundant in a culture say of two weeks' growth than in one which is only twenty-four hours old. It will be remembered that my cultures were usually allowed to remain undisturbed for two weeks, as in this time I obtained a more concentrated culture, and consequently a more satisfactory filtrate.

To eliminate to a considerable extent the agency of these bacterio-proteins the cultures were filtered when they were only twenty-four hours old. Five experiments were made with a filtrate of this character.

CASE I.—White rabbit. Ten drops of filtrate were injected into the conjunctiva of the right eye. Same quantity of sterile bouillon was injected into the conjunctiva of the left eye. The next day there was a well-marked redness of the right eyeball, while the left eye showed no change. The toxin in this case was of *staphylococcus pyogenes aureus.*

CASE II.—*Same Toxin.* Same rabbit. Left eye. Ten drops of filtrate were injected. The result was the same as in Case I.

Bacillus Coli Communis.—CASE I.—White and gray rabbit. Right eye. Injected ten drops of filtrate into the conjunctiva. A decided conjunctivitis followed.

CASE II.—Same rabbit. Left eye. Ten drops of filtrate

were injected into the conjunctiva. Next day there was a slight conjunctivitis.

Diphtheria Toxin.—Case I.—Black rabbit. Right eye. Injected ten drops of filtrate into the conjunctiva and the same quantity of sterile bouillon into the conjunctiva of the other eye. There was a conjunctivitis in the right eye the next day and slight redness of the fellow eye, which latter condition I interpreted as being due, in all probability, to some mechanical injury of the conjunctiva at the injection.

It will be seen from this that the elimination to a large extent from the filtrate of the bacterio-proteins had scarcely more than an appreciable effect upon the character of the reaction. In these last five cases the congestion of the conjunctiva was possibly a little more localized around the point of the injection than was the case in the other experiments of this division of the work, and this we might interpret as being due in part to the feebler concentration of the culture as well as to the smaller quantity of bacterio-proteins.

Part III. The Effect of the Toxins when they are Injected into the Anterior Chamber.

The following was made as a control experiment: A Graefe cataract knife was passed into the cornea at its upper scleral border. Through this incision ten drops of sterile bouillon were injected into the anterior chamber. The next day, with the exception of a very small hernia of the iris and three or four vessels grouped at the point of the wound, the eye was normal. On the second day the congestion had entirely disappeared, but the slight irregularity in the pupil persisted, and this is due to the incarceration of the iris in the lips of the incision, and it will never disappear. There was, however, not the slightest sign of an iritis.

The following experiments were then made:

Gonococcus Toxin.—Case I.—White rabbit. Right eye. Anterior chamber was opened as in the preceding case and five drops of the filtrate injected from a hypodermic syringe. The next day there was pericorneal congestion, which was more marked at the point of the incision. The aqueous was slightly cloudy. Iritis. In seven days the symptoms had entirely disappeared.

Diphtheria Toxin.—Case II.—Same rabbit, ten days later. Left eye was utilized. An incision was made in the usual manner above, just as we do in a cataract incision, except that the incision in the experiment is, of course, much smaller. Ten drops of the filtrate were injected through this incision into the anterior chamber. The next day there was a very intense iritis, showing itself in practically the same symptoms as in Case I. The eye had cleared up in a week.

Bacillus Coli Communis Toxin.—Case III.—Gray rabbit. Injected ten drops of filtrate into the anterior chamber above. Next day there was iritis, with the usual symptoms.

Pneumococcus Toxin.—Case IV.—Gray rabbit. Left eye. Injected into the anterior chamber ten drops of the filtrate. In twenty-four hours there was iritis, which did not differ materially from what was seen in Case II.

Staphylococcus Aureus Toxin.—Case V.—White and black rabbit. Right eye. Ten drops of filtrate were injected into the anterior chamber. Result was the same as in the last two cases.

Micrococcus Epidermidis Albus Toxin.—Case VI.—Ten days later fifteen drops of the filtrate were injected into the anterior chamber of the left eye. I saw no material difference in the reaction from that in the preceding case.

At first sight one would suppose that the reaction in experiments of this character would be more intense, more destructive than when the injection was made into the conjunctiva. The absence of panophthalmitis and closed pupil is explained by the fact that some at least of the filtrate oozed out of the anterior chamber. As long as the wound was open, and no doubt it remained so for several hours, there was more or less oozing. The filtrate which remained was certainly considerably diluted by the rapidly regenerating aqueous, so the toxin in its original condition remained for a very brief space of time in the anterior chamber, but quite long enough to light up inflammation; and no doubt is left in my mind that had I injected the toxin through a needle-hole opening right into the anterior chamber serious results would have followed, for in this case the tension of the eye would have been markedly increased, and the toxin would have been retained.

In the conjunctival injections the needle-hole closed on withdrawing the needle, and there was apparently no oozing, the bleb remaining for some little time after the experiment.

We have evidence enough to show, then, that the filtrate from the cultures of the organisms which were used in these experiments is sufficiently irritating to set up inflammation in the conjunctiva and in the iris. That the bacteria in the rabbit's conjunctiva play a part in this inflammation is almost certain. The effect of the toxin is simply to irritate, and in this way to lessen local resistance. We know that the normal human conjunctiva is rarely if ever free of bacteria, several of which have very slight pathogenic properties, but that when an irritant is applied to the eyeball the conditions are at once produced under which these very organisms become pathogenic and do harm.

Mention has been made of several works upon the bacteriology of the normal human conjunctiva; but, so far as I know, no work has been done upon the bacteriology of the rabbit's conjunctiva—an important omission when we consider that practically all of the experimental work of the ophthalmologist is done upon the rabbit's eye.

It has occurred to me, in this connection, to make an examination of the normal conjunctiva of the rabbit, to see whether its bacteriology resembles that of the human conjunctiva, and this brings me to Part IV.

Part IV. The Bacteriology of the Normal Conjunctiva of the Rabbit Based upon an Examination of Forty-seven Cases.

The technique consisted in rubbing a rather large, sterile platinum loop over the conjunctiva of the eyeball, and carrying it well into the conjunctival sac, from which points inoculations were made into the fluid agar. Plate cultures were always made.

1. Two whitish, well-defined colonies; both micrococci.
2. Two colonies; one evidently an impurity, the other a micrococcus.
3. One colony; micrococcus, which was like the coccus found in 1 and 2.
4. One colony; similar to 3.
5. Several small colonies; whitish; all proved to be micrococci.
6. Coccus similar to preceding; a large bacillus.
7. Plate was covered with small colonies; micrococcus like 1 and 2.
8. Several colonies. The large colored ones proved to be a big bacillus. There was a streptococcus colony; also a micrococcus similar to 1 and 2.
9. Four colonies, all of which were micrococci.
10. Two colonies; one proved to be a bacillus, the other a micrococcus.
11. Micrococcus, like the preceding; also a large, yellowish colony, proving to be a big bacillus.
12. A colony which covered a large area, proving to be a big bacillus; also a micrococcus.
13. Several yellowish colonies; bacilli of different sizes.
14. Several yellowish colonies, which proved to be a short bacillus; also a number of whitish colonies, which were micrococci like 1 and 2.
15. A number of colonies; all micrococci like those seen in 14.
16. Abundant growth; micrococci like the preceding.
17. Abundant growth; micrococci like the preceding.
18. Several colonies; micrococci like the preceding.
19. Two colonies, one of which was a large bacillus and the other a large coccus.
20. One large colony, which proved to be a large coccus, and several smaller colonies, which proved to be micrococci like those frequently seen in preceding cases.
21. Several colonies; micrococcus.
22. Several colonies; micrococcus.
23. One colony; micrococcus.
24. One large colony, which proved to be a big, short bacillus.
25. Several colonies; micrococci like those in 1 and 2.
26. Several colonies; micrococci like the preceding. There was a yellowish colony in this plate, but an examination of the organism showed it to be a micrococcus not differing morphologically from the other coccus.
27. Two colonies, one whitish and the other yellowish-white; micrococci which did not differ morphologically.
28. Nothing grew in this plate.
29. One large colony, covering half the plate, which proved to be *Bacillus subtilis*. There were other small colonies in this plate, some of which were micrococci like 1 and 2, and others were very small bacilli.
30. Three colonies, which proved to be very fine bacilli.
31. Several colonies. One was a large coccus and the others were short bacilli.
32. A number of colonies which were sharply round and white, some consisting of a large coccus, and others were micrococci.
33. Several colonies, consisting, for the most part, of diplococci and large cocci.
34. Two colonies; both diplococci.
35. Several colonies; micrococcus like that in 1 and 2; fine streptococcus.
36. Micrococcus similar to 1 and 2.
37. A number of colonies, consisting for the most part of micrococci like those in 1 and 2; also a fine streptococcus.
38. A number of colonies; micrococci like 1 and 2.
39. Rather large coccus. A number of other colonies, which were micrococci like 1 and 2.
40. Two colonies. One was a large coccus, while the other was a micrococcus like 1 and 2.
41. A number of colonies, most of which were micrococci like 1 and 2. There was also a growth which proved to be a fine streptococcus.
42. Large number of colonies which proved to be a big coccus, and one colony which was a fine streptococcus.
43. One colony; micrococcus like 1 and 2.
44. Several colonies; large coccus; micrococcus like 1 and 2.
45. Number of colonies; same micrococcus as in 1 and 2.
46. Number of colonies; same micrococcus as in 1 and 2.
47. Number of colonies; same micrococcus as in 1 and 2.

From a study of these cases it appears that the normal conjunctiva of the rabbit contains quite a variety of bacteria. There was more often found, however, a micrococcus which proved to be the staphylococcus albus. This organism occurred in thirty-six out of the forty-seven cases (1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16, 17, 18, 20, 21, 22, 23, 25, 26, 27, 29, 32, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45, 46, 47).

The staphylococcus albus, as we know, is feebly pathogenic; but given sufficient irritation it can and often does produce inflammation, and it is reasonable to presume that this organism was frequently concerned in causing the conjunctivitis and iritis recorded in Parts II and III.

At any rate, the normal conjunctiva of the rabbit, like the normal human conjunctiva, is probably never sterile. In only one case (Case XXVIII) was there a sterile plate.

Epicritical Observations.—The foregoing experiments are of interest in several respects. The forty experiments recorded in Part I indicate that simple contact of bacterial toxins with the normal conjunctiva produces no local inflammation or other injury to the animal. This is in accordance with what is already known concerning the behavior of this

class of poisons when applied to other intact mucous surfaces. Unlike alkaloidal and many other kinds of poisons, the chemically undefined toxins produced by bacterial cells, as well as similar toxins produced by certain cells of higher plants (ricin, abrin) and of animals (snake venom), are in general incapable of absorption from intact mucous surfaces, although before the present series of experiments this had not been satisfactorily demonstrated in the case of the conjunctival mucous membrane.

Not only are the toxins not absorbed under these circumstances, but they do no damage to the intact epithelium. In fact, it is probably this absence of local injury induced by the bacterial toxins which explains the lack of absorption of the toxins. That there are special epithelio-toxins capable of damaging epithelial cells has been demonstrated by von Dungern[25] and others, but such specific toxins for epithelium have not been discovered in filtrates of bacterial cultures. We know, however, that certain bacterial toxins, notably the diphtheria toxin, may act injuriously upon previously altered epithelial cells, and further investigations may show the existence of bacterial toxins capable of directly injuring intact epithelium.

The experiments recorded in this paper, therefore, indicate the great importance of integrity of the epithelial surfaces in protecting against local and general injuries from toxins secreted by bacteria. We were already familiar with this protective influence in guarding against local and general infections by the bacteria themselves, although there are bacteria which can attack the normal epithelium. Inasmuch as bacteria in general are more virulent when they are accompanied by their toxins at the time of their invading the animal body, it seemed important to determine, as has been done in this paper, the action of the toxins separated from the bacteria upon the intact conjunctival membrane.

To what extent the protection afforded by intact epithelium against bacterial toxins is purely mechanical, or is due to incapacity of the toxin to enter into a chemical union with the epithelial cell in the sense of Ehrlich's "side-chain" theory or to other causes, I have not attempted to determine. When, however, the toxin has gained access to the subepithelial tissues we find the conditions entirely different.

The numerous experiments recorded in Part II demonstrate that filtrates from both young and old cultures of all the various bacterial species used contain some irritative poison capable of setting up local inflammation when these filtrates are injected into the substance of the conjunctival mucous membrane. Certain of the bacterial species employed produced more powerful irritative poisons than others, the strongest of these toxins being found, in the present experiments, in cultures of the gonococcus, the diphtheria bacillus, and the colon bacillus, but notable effects were obtained with cultures of the pyogenic micrococci.

That the substances concerned in producing these local inflammations are specific products of the bacteria, and are not attributable to ingredients of the original culture media, was abundantly demonstrated by the fact that control injections of the uninoculated culture media even in much larger doses were entirely without any injurious effect.

It is possible that bacteria normally present in the rabbit's conjunctival sac may have participated in causing the inflammations which regularly followed the injections of the toxins into the conjunctival membrane. In Part IV, I have shown that the normal conjunctival sac of the rabbit contains a variety of bacteria, and that among these a white staphylococcus resembling if not identical with the staphylococcus albus (staphylococcus epidermidis albus) is common. But the primary and essential damage is that which is inflicted by the toxin, as the control experiments show; and if bacteria were secondarily active it is because the soil was prepared for them by the damage done to the cells and tissues by the toxins.

I can readily understand that such ordinarily harmless bacteria as the white staphylococcus or other common bacterial inhabitants of the conjunctival sac may gain a foothold and multiply in tissues whose vital resistance has been impaired by the previous action of toxins.

After it had been determined that bacterial toxins introduced into the connective tissue of the conjunctiva cause inflammation it was not surprising to find that a similar result followed the injection of the same toxins into the anterior chamber of the eye, as is demonstrated by the experiments recorded in Part III.

There is another aspect of the experiments which is of considerable interest. Filtrates were used from cultures not only of bacteria known to produce powerful soluble toxins, but also of those not before positively known to secrete soluble toxins. Inasmuch as we have at present no means of determining whether a given bacterium secretes a toxin or not, except by the biological test, it has been generally assumed that when this test fails there is no evidence of the existence of such a toxin. But it may be asked whether in all instances sufficiently delicate tests have been made?

The need of caution in drawing conclusions in this matter is made evident by the interesting experiments of Kraus,[26] who has shown that specific soluble bacterial products previously unsuspected are present in the fluid cultures of the typhoid bacillus, the cholera bacillus, and other bacteria, and can be revealed by the action of the homologous antiserum. That toxins may have peculiar specific effects upon certain cells, and that these effects may be of such a nature that they are readily overlooked until careful search is made for them, has been shown by the discovery in recent years of the various cytolysins produced by the pyogenic staphylococci and the tetanus bacillus.

It is from this point of view of interest that all of the bacteria which I employed were demonstrated to produce toxins capable of causing injury and inflammation of the tissues of the conjunctiva. Injection into the eye, particularly into the substance of the conjunctiva, would seem, therefore, to make a more delicate biological test for the recognition of certain toxins than the tests which have usually been

employed to determine this point. That the toxins concerned were not simply the so-called bacterio-proteins of Buchner, derived from degenerated and macerated bacterial cells, was proven by the determination of the toxicity of young cultures.

The experiments recorded in this paper are in harmony with clinical experience, and they shed some light upon questions of clinical interest. We know that in a large proportion of cases of infectious inflammations of the eye a lesion of continuity is demonstrable or can reasonably be inferred. This lesion is now shown to be important not only in opening a path for the invasion of bacteria and in weakening the local vital resistance to bacteria, but also in permitting the entrance of toxins which constitute the weapons by which the bacterial cells do injury. Without this opportunity for the penetration and action of toxins even highly virulent bacteria may be harmless, as has been shown in the case of the tetanus bacillus, and with this opportunity bacteria of even very weak virulence, such as the common white staphylococcus, may be pathogenic. In support of these views I need not dwell upon conditions where the injury is manifest, as in postoperative inflammations, penetrating wounds of the eyeball, serpent ulcer, etc. I am of the opinion that many cases of gonorrhœal ophthalmia and of "pink eye" are produced not by the simple introduction of the specific bacterium into the healthy conjunctival sac, but by the bacterium acting upon a conjunctiva slightly injured, even if the injury be no more than the slight abrasion of the conjunctival epithelium which may result from rubbing the eyes with the fingers. I have seen in the last two years two cases of gonorrhœal ophthalmia resulting from the spurting of fluid from a pyosalpinx into the eye of the operator, and in each instance this accident was followed by violent rubbing of the eye, which would produce a lesion of the conjunctival epithelium.

How often we meet with gonorrhœal ophthalmia as a monolateral affection!—in fact, in the majority of cases. What a very common disease is gonorrhœa, and how comparatively infrequent is gonorrhœal ophthalmia!

It can hardly be otherwise than that the gonorrhœal virus often gains access to the conjunctival sac without setting up inflammation.

It must often happen in cases of highly infectious inflammations of one eye that the infectious germs are conveyed to the other eye without resulting injury. While every precaution should be taken to guard against such a contingency, it is probable that our protective measures are effective in many instances as much by preventing slight local abrasions as by the exclusion of the infectious bacteria.

We know that it is scarcely within the power of the surgeon to exclude absolutely all bacteria from wounds, and that in so-called aseptic wounds bacteria, sometimes even pathogenic forms, are present. Nothing is easier than the entrance of bacteria into the conjunctival sac, nor can we rid the sac entirely of micro-organisms. Whether or not bacteria already present do harm depends upon a number of circumstances, and among the most important of these circumstances is the condition as regards integrity of the conjunctival surface.

My experiments have demonstrated, I think, the importance of this factor in relation to toxins; and also that pathogenic bacteria, even those for which toxins had not previously been satisfactorily demonstrated, do harm through the action of specific soluble poisons.

What, then, is the conclusion of the whole matter?

1. Bacterial toxins, so far as tested, when instilled even for many hours into the healthy conjunctival sac were found incapable of producing inflammation or causing other injury.

2. The same toxins when injected into the tissue of the conjunctiva or into the anterior chamber invariably set up local inflammation, the extent and intensity of the inflammation varying to some degree, according to the species of bacterium yielding the toxin.

3. Bacteria which had not previously been proven to produce soluble toxins were found to produce them even in young cultures, and it is suggested that injections of bacterial filtrates into the eye, particularly into the conjunctival tissue, constitute a more delicate biological test for the detection of certain toxins than the tests usually employed for this purpose.

4. The experiments recorded in this paper furnish additional examples, in a comparatively new field, of the importance of toxins in explaining the pathogenic action of bacteria, and likewise emphasize the etiological significance of injuries of the covering membrane of the eye in favoring the action of toxins and of bacteria.

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PLAGUE IN THE ORIENT.

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As plague has periodically recurred in pandemic form, lasting from several years to fifty or sixty years, has formed new endemic homes, and of late has reappeared in Asia to spread to all parts of the world, making many new distributing points and establishing many temporary endemic centers, its mode of self-perpetuation, extension and the geographical and sociological conditions best suited to facilitate these phenomena are questions of paramount importance in these, the early years of the present pandemic.

In this paper a brief discussion of some features of *Bacillus pestis* and the infection in animals and insects is necessary. Its viability and virulence are most important. Numerous observers have recorded its long life and resistance to various injurious influences. Organisms have remained alive in culture media for many months; on dried pulverized organs of animals dead of plague for forty-eight days; on dried paper in a thermostat for forty-four days; on paper, silk, etc., in a room at ordinary temperature in sunlight for eighteen days, and in direct sunlight for from four to five hours. Its virulence is also long maintained. Old cultures are frequently as virulent as young ones. Full virulence has been noted after forty-eight days in dried organs and after seventeen days in dry paper in a thermostat. Most of the lower animals and some insects are susceptible to plague; rats, mice, fleas and flies are, perhaps, of most importance. These animals and insects preserve the virulence of the organism, spread it in excreta and their decaying cadavers and pick up virulent organisms in food-stuff, raw goods and various kinds of infected material. Rats suffering from gangrene or an old ulcer following a suppurating bubo may preserve the life and virulence of the organism for a long time and spread it from place to place. The long life of the organism and its maintenance of virulency are sufficient to explain the introduction of the disease into distant lands and to furnish infection for a succeeding annual epidemic. The occurrence of an occasional case of plague in a previously infected city may furnish a fresh culture of *Bacillus pestis*. Lastly, a very small number of bacilli may produce infection in a superficial, even microscopic, wound.

Regarding direct and indirect transmission of plague, it may be said that indirect transmission plays the most important role. It has been noted by all observers that those, apparently, most exposed to infection rarely contract the disease. The high resistance of the organism to various harmful agencies and its maintenance of virulence under unfavorable conditions are, I fear, not sufficiently appreciated. Animals and insects serve more to preserve the bacilli and spread them to accessible places than to transmit the disease directly. Infected merchandise is most important. The relative location of primary buboes in the lower classes points to the importance of infected dwellings, filth and merchandise.

All nations are susceptible. An apparent racial immunity depends on some national characteristics, most important of which are dress and cleanliness.

The cosmopolitan features of *Bacillus pestis* enables this organism to form endemic centers in any climate or city offering sufficient filth and ignorance. In ancient times many of the epidemics began in Egypt to spread along the shores of the Mediterranean to Asia Minor, Turkey and Europe. For many years Turkey furnished an endemic home, but as civilization advanced plague disappeared. Gradually the disease traveled through Asia Minor to Asia, China and India. Here the chief endemic centers are found. But are these localities all? Plague exists in many countries where it appears from year to year. Even San Francisco had a number of cases last year. May not such localities be temporary or permanent homes from which epidemics may spring? With occasional cases of plague in San Francisco, can we longer say that this disease cannot gain a foot-hold in our country? Does the Chinese District in San Francisco differ from similar districts in other lands? The presence of plague answers these questions.

The conditions in the Orient most favorable to the spread-

ing of plague may be discussed under the headings of the people, their cities and commerce. As China, especially Canton and Hong Kong, are of most interest and importance, the conditions there found will be given in some detail.

Generally speaking, oriental cities are old and substantially built in a style least favorable to hygienic measures. Accumulated filth in houses, yards and streets apparently has been unseen by passing generations.

Kwang-tung is one of the largest and wealthiest provinces in China. Its soil is fertile and well watered.

Canton, the capitol of Kwang-tung, is situated on the Pearl River about seventy miles north of Macao and ninety miles northwest of Hong Kong. It is in latitude 23° 7′ 10″ N., and longitude 113° 14′ 30″ E., about the same parallel as Havana. Its history dates from the second century B. C., when traders entered the city. The old city is surrounded by a high wall, about six miles in circumference; a partition wall divides the city into unequal districts. A moat used to surround the city. Several canals enter the city from the river. Through these the tide aids in cleaning the city. Its exact population is unknown; it is estimated at several millions, and steadily increasing. On account of its favorable geographical location, Canton has long been one of the most important commercial cities in China and to-day is perhaps the richest. The streets are crooked, narrow and usually paved with stone. Surface drainage is most frequent. The houses are substantially built, poorly ventilated, containing many interior rooms. In the foreign settlements many modern buildings may be seen.

The material characteristics of the Chinese vary greatly. According to our modern ideas these people are uneducated, especially as regards sanitation and diseases. Owing to overpopulation, competition is severe, allowing each but little more than the necessities of life, which in tropical and subtropical regions are but little more than food. Their food is purchased ready cooked from street venders, whose outfit consists of a small box, sometimes on wheels, in which an oil stove keeps a vegetable and meat soup hot. Almost any Chinese delicacy may be fished out of this pot. The outfit looks filthy and is usually kept by a lazy, filthy Chinaman who seems to care little for his business.

Their stores are usually small but well filled; a portion of the rear end is partitioned off for an office or residence. This back room is usually dark and filled to overflowing with all sorts of traps. If used as a residence one or more platforms as wide as a man is tall about eighteen inches apart, are placed one above another along one side of the room. The floor and each platform are used as beds, in which the Chinamen lie side by side with their feet toward the wall. In this manner a large number of people may live in one small, poorly ventilated room. The floors above the stores are used as residences or factories, or both. Here the same bunk arrangement may be seen. Usually the sleeping rooms are poorly kept and the amount of filth found is often astonishing, while the stench is frequently sickening. The number of individuals living in one small house is often astonishing; as many as one hundred and eighty have been found living in a house elsewhere occupied by a family of six or seven. During the day most, if not all, of these individuals go out for work. In the absence of an acute sense of cleanliness, the filth accumulating from such crowds must be great. The occupants seem to live with it and to like it.

In the absence of sewers and garbage carriers, filth rapidly accumulates in the yards and streets, where decaying vegetable and animal matter always exists. Often the stench is repulsive; in other places the hot sun retards decomposition by drying the decomposing matter. Their market places are often most vile. Thus the lower classes live, walk, sit and eat in filth. These conditions furnish food for rats, mice and insects, which exist in great numbers. As scavengers they are often a blessing. The organic matter furnishes media for bacteria of all kinds. Multitudes living under such conditions must be in a state of lowered resistance and susceptible to any disease introduced among them. As their national customs are in many respects similar in every city, but little choice is to be had regarding a more suitable habitation.

For economical reasons dwellings are used as work shops or factories. When through with their day's work the laborers clear a space on the floor for the night or lie close in rows on platforms built along the walls, high enough above the floor to allow an ordinary man to walk under. In these rooms all manufactured products come in intimate contact with Oriental filth which may be infected; in fact it is surprising that more infection is not carried. Much of the manufactured goods are in the form of fabrics, paper goods, toys, etc., which in turn are packed in straw or paper previously in contact with the same filth or which has served as the habitation and play house of rats, mice and insects.

Religious notions and superstitions of various kinds give to the ignorant natives many peculiar ideas regarding modern sanitary and hospital methods. A Chinese hospital is as dark as a dungeon. If the ward has windows they are tightly closed with boards. Usually a single door opens into the ward. Along either side is built a continuous platform about eighteen inches above the floor and somewhat wider than a man is tall. From a wire suspended about eight feet above the floor a curtain hangs in front of the platforms closing them from view and forming a narrow aisle along the center of the room. From these curtains partition curtains extend to the walls, dividing the platforms into a number of compartments. In these small, dark, poorly ventilated, unfurnished compartments, a form of private wards, the unfortunate patient exists until recovery or death sanctions his release. If light is needed a small glass tumbler three-fourths filled with oil, on which a small taper floats, is used. A more dismal conception of hospital architecture and sanitary measures would be difficult to imagine. Yet the majority of these people absolutely refuse treatment in our modern hospitals. In discussing these questions a prominent Chinaman once said to me, "You know we are not educated to your way of living, and you must not expect

too much of us until you teach us what to do and how to do it. We are willing to do the best we know." The dread of modern methods causes Chinamen in Hong Kong to conceal their sick until death when, because of the cost of burial, permits and disinfection, they are cast into the streets for the city authorities to bury. In the case of plague cadavers this practice is most dangerous, as the cadaver is teeming with plague bacilli. It is also impossible to ascertain in which house the case died. Because of the infectious character of the excreta and sputum, and the generally filthy condition of the people, a single case in a crowded house may serve to infect not only individuals living in the house but also may spread infection wherever its occupants may go. It is a favorite custom of the Chinese to collect in large numbers in certain places to talk over subjects of common interest, to gamble and to smoke their favorite pipe; here a few infected individuals may rapidly spread infection.

It may be said that wherever Chinamen locate in numbers a Chinese district is at once established, where all of their national customs are practiced. Here the same filthy, crowded condition exists.

Yet, with all his faults, some respect is due the Chinaman. He belongs to one of the oldest nations; he has been raised to hard work and honesty, and he conscientiously lives up to his religious ideas, whatever they are. In his ignorance his surroundings seem to him to be the best. If we judge him in the light of our own tenacity of the customs of our fathers, it would seem most unnatural to expect him to be willing to cast aside his traditions at our bidding. On the other hand, he is an intelligent individual, aspiring for success, and is usually willing to do whatever best promotes his progress. To us disinfection and light, comfortable hospitals are necessities; to him, they are unknown. As bacteriology in its lay sense is unknown to him, it is practically impossible to explain disinfection. After days of teaching, with demonstrations, the idea becomes in a measure clear to him. Then he is willing to take an active part in promoting sanitary measures. Unfortunately, too few of us are willing to take the necessary time and patience to teach them. It may be said that when their education is undertaken in the proper spirit Chinamen are anxious to know all we know, for they see our progress and have noted our encroachment on their territory. As an example of what may be done, I will cite the part taken by the Chinese in the epidemics of plague in Manila. When plague was discovered, the Chinese consul and a prominent merchant, Señor Palanca, representing the two Chinese factions in Manila, were asked to come to the office of the board of health. Here they were informed that plague was in the city and would most probably affect their countrymen and that the American authorities desired to help in every way possible to protect their people. Certain procedures were suggested. The two Chinamen listened to all that was said and asked for time to consider the matter. This conference resulted in the erection of a Chinese plague hospital, with Chinese doctors and attendants, and the organization of a corps of Chinese inspectors, who reported every morning to a member of the board of health the probable diagnosis of every sick Chinaman in the city. During the day an American physician with a Chinese interpreter visited the reported cases, which, if found to be plague, were removed to the hospital. Later the house with its contents was disinfected. Approached in this manner, these Chinamen saw that it was for their interest to help combat the disease with the best known methods. When asked for an autopsy, they said, if you insist, we cannot prevent; but if you make it, our people will no longer cooperate, as this practice is contrary to our religious beliefs. It is my belief that if Chinamen are understood and diplomatically handled, they can easily be influenced to improve their present hygienic methods, but if opposed they resist unto death. It seems to be a general idea among civilized races that Chinamen have no rights worthy of consideration. Naturally this is an unfortunate mistake, seen quicker by the Chinamen than realized by those coming in daily contact with the shrewd merchant of the Orient. Under false impressions that nothing can be done to prevent the disease, plague has been given a free berth and hand in the city of Canton with its millions of people. There the disease is said to be epidemic, increasing or decreasing, but always present. In a city of the population of Canton a large death rate resembles a clearance sale in a large department store; more space is given for new material. Absolutely no steps are taken to relieve the situation. Canton is in constant communication by land and water with its nearby seaport, Hong Kong. The voyage is made by water in a single night, and an individual may contract plague in Canton and develop the disease in Hong Kong, or an infection may be carried in merchandise, etc. Granting that Hong Kong could exterminate plague as rapidly as it is found, Canton would easily and surely reinfect the city as often as it had been disinfected.

Of all Oriental cities Hong Kong, on account of its enormous shipping interests, is by far the most important. Practically every steamer plying in Oriental waters touches at Hong Kong for coal, merchandise or passengers. There all freight, baggage and coal are handled by Chinese coolies, who, living in the filthiest portions of the city, are most exposed to infection. In addition to handling the freight these individuals when aboard a liner go wherever their fancy dictates. Rats also in large numbers often board the steamers. I have heard passengers say that while in Hong Kong rats came aboard in such numbers as to be a nuisance. From Hong Kong these steamers go to all ports in the world to discharge their cargoes of merchandise, rats and bubonic plague. With Canton as a plague supply depot and Hong Kong as a distributing point, it is not surprising that within the short space of a few years plague has been spread over the civilized world. But this is not all; granting that the civilized world could successfully combat plague, it would soon be reintroduced from Canton through Hong Kong. History shows that epidemics of plague continue from a few years to fifty or sixty years, and in endemic homes are always present. So we may infer that for the next fifty years at least

Canton may supply the world with plague infection. If all the population of Canton were destroyed by plague, the city could be repopulated in a day from the surrounding districts. Accustomed now to the death rate, ignorant as to its cause, there are millions upon millions of Chinamen anxious to take up city life as offering more lucrative employment than can be had in the country districts. Plague soil must remain fertile as long as millions of ignorant people live in the filthy overcrowded city.

Doubtless Hong Kong originally received its infection from Canton, but now the disease is continually present, often in epidemic form; to all intents Hong Kong is an endemic home.

Sufficient has already been said regarding plague in India.

The exact method of introduction of plague into Manila has not been determined. Whenever possible Chinamen often visit their home people. Consequently on every steamer plying between Manila and Hong Kong may be seen numerous Chinese passengers, who must land in Hong Kong to take small coasters or travel overland. While in Hong Kong these travelers stop in the Chinese quarters where plague infection abounds. On their return trip a second stay in Hong Kong is necessary. In this way and by merchandise, rats and the like, infection can easily be carried to Manila.

In Manila the conditions favoring the spreading of plague are about the same as they are in China. The people are poorly clothed and fed, crowded together in poorly constructed and illy ventilated houses and as ignorant as human beings could well be.

Impoverished by several years' war, foodstuffs are high and the natives must exist on almost nothing. Consequently their ability to resist disease must be reduced and they are susceptible to any infection introduced among them. Intimate intercourse between Manila and numerous neighboring towns and islands has long existed. Since the American occupation intercourse with Hong Kong has been greatly increased. During 1899 and 1900 quarantine in name only existed in Manila, a useless official inspection being practiced. Early in the summer of 1899, attention was called to the prevalence of plague in nearby ports and the possibility of introducing the disease, and also cholera, into the Philippines, but in his universal wisdom the Military Governor disapproved all recommendations. In December, 1899, plague was discovered in Manila.

Owing to an unguarded intercourse plague gradually spread to a number of the neighboring towns, but not to an alarming degree.

In brief, it may be said that in any country, in any climate, the conditions which most favor the spreading of plague are poverty, poor food and dwellings, and ignorance. Of these ignorance is perhaps most important. Nowhere are these conditions better filled than in the Orient.

PEMPHIGUS VEGETANS.

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AND

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The conception of pemphigus has undergone a marked change since the beginning of the century just past. At that time any condition of the skin characterized by a bullous eruption was included in the class of pemphigus. There was a leprotic pemphigus, a syphilitic pemphigus, a pemphigus the result of burns, a neurotic form, a form following the use of drugs, and so on. To such an extent did physicians "torture one poor word" that Martius[1] could enumerate in 1829 ninety-six varieties of the "disease." Gradually, however, the use of the word was discontinued in referring to cutaneous conditions where the etiology of the bullous eruption was known or seemed probable. Instead of describing leprotic and syphilitic pemphigus, it seemed more appropriate to speak of these eruptions as the bullous exanthems of leprosy and syphilis. The neurotic form came to find its place under the nervous maladies of the skin and in a similar manner a number of other varieties was classified. A contribution to this process of exclusion was added when Hebra defined erythema multiforme and thus eliminated a great group of cases from this chaotic collection. It is to this master, too, that we are indebted for the criteria, which determine, even at the present time, the classification of a bullous eruption under the caption of "pemphigus".[2]

Essentially a chronic disease of the skin and mucous membranes of unknown etiology, pemphigus is characterized by successive eruptions of bullæ with subjective symptoms, either absent or present, in varying degree, and offering a prognosis dependent upon the particular variety of the disease under consideration.

At present, four varieties of the disease are distinguished. The common form, pemphigus vulgaris, has been long recognized. Its firm bullæ, its tendency to recurrence and its doubtful prognosis are well known. The differentiation of the other three has been accomplished by the publica-

[1] Ueber d. Blasenausschlag oder Pemph., Berlin.

[2] Virchow, Handb. d. spec. Path. u. Therap., 1874, 2te Auflage, Bd. III.

tion of a series of three papers which will be briefly mentioned.

In 1844, Cazenave[3] separated the variety which has since been repeatedly recognized and described under the title of pemphigus foliaceous. The flaccid blebs soon rupturing, the surrounding epithelium becomes detached. The epithelial exfoliation continuing, great areas of skin are denuded until, it may be, the whole body is flayed. The mucous membranes, hair and nails are in the meanwhile involved and the patient exhausted by sleeplessness, pain, fever and digestive disturbances succumbs.

In the years following Cazenave's publication many obscure examples of bullous eruptions were described. Each observer did not hesitate to suggest a name for the affection he reported and so there accumulated a confusing mass of material. In this group certain differences were apparent. One set was characterized by a bullous eruption, frequent involvement of the mucous membranes and slight disturbance of the cutaneous sensibility. These disorders ran a malignant course and were in some instances regarded as anomalous forms of syphilis.

A second group declared itself by the multiformity of its manifestations for, in addition to the characteristic bullous and vesicular efflorescences, other elementary lesions were represented. These cases showed remissions and recurrences and did not, as a rule, attack the mucous membranes. They were benign and accompanied by pruritus and paræsthesia. Recognizing these differences, Duhring[4] in 1884 separated this second group and created the dermatosis which bears his name.

No cutaneous disease has given rise to more lively debate than has Duhring's dermatitis herpetiformis. Its very right to a separate existence has been assailed by no less an authority than Kaposi[5] and its nosologic position has not yet been thoroughly settled. It may, however, be assumed that it is entitled to be regarded for the present as a clinical entity. The question is bound up in a consideration of the relation of the disease to other inflammatory conditions of the skin. Kaposi would have us regard dermatitis herpetiformis as a refuge in classifying atypical cases of erythema multiforme and pemphigus. So long as etiological, pathological and bacteriological criteria are wanting, the differential diagnosis must depend upon the clinical picture and the evolution of the disease. These are sufficient to differentiate dermatitis herpetiformis from erythema multiforme in a majority of instances. In the one the irregular distribution of the lesions and the striking subjective symptoms contrast strongly with the preference of erythema multiforme to attack the dorsum of the hands and feet and with the usual absence or mildness of itching and burning.

The relation of Duhring's dermatosis to pemphigus, however, is much more intimate. Indeed Duhring, himself, states that "The semblance in some, but by no means all cases to pemphigus naturally suggests a close relationship of the two diseases and that such exists in these cases there can be no doubt."[6] He reports a case in which the condition at one time would have been diagnosed pemphigus and which he subsequently classified as dermatitis herpetiformis because of the presence of peculiar vesicles, blebs, and pustules, in combination. Though it is unquestionable that the polymorphism, the herpetiform arrangement of the lesions and the subjective symptoms create a special place for Duhring's dermatosis, the intimate relation to pemphigus should, for the time being, be emphasized by considering it as a variety of this disease. The commoner types of pemphigus itself do not always present uniform pictures and though the characteristic lesion is a bulla, the bleb may rise from an erythematous base and wheals and pustules may be present. The eruption is occasionally grouped and subjective symptoms are at times prominent so that there are well recognized and generally accepted examples of chronic pemphigus which form connecting links between the common varieties and dermatitis herpetiformis. The modifying terms serpiginous, pruriginous, and gyrate, illustrate this transition. The future may provide an etiological basis for a more satisfactory classification but until then it seems advisable to group with pemphigus vulgaris and pemphigus foliaceous, Duhring's dermatitis herpetiformis.

The fourth variety of chronic pemphigus was defined by Neumann in 1886. It is from this form of the disease, pemphigus vegetans, that the patient whose history and condition will subsequently be recounted, suffered. The early history of this disease was referred to in sketching the origin of dermatitis herpetiformis. There, a certain class of bullous eruptions pursuing a malignant course was contrasted with a group of benign affections which Duhring embraced in the description of his dermatosis. It was also stated that they were sometimes regarded as varieties of syphilis and it may be added that this view continued to be held until Neumann recognized their connection with chronic pemphigus and published his opinion in the Vierteljahrschrift für Dermatologie und Syphilis in 1886.

Previously, under the title of Herpes vegetans, Auspitz[8] described what Neumann viewed as the affection under consideration. Moreover, as syphilis cutanea papillomaformis (vegetans) or frambœsia syphilitica, Kaposi[9] reported a case likewise supposed to be of a similar nature. In none of these instances is the condition of the mucous membranes indicated. Besides, in the patients of Auspitz, the occurrence of pregnancy and the presence of syphilis in one of them, complicated the diagnosis. At the present moment

[3] Ann. des Maladies de la Peau et de la Syphilis, tome 1, p. 208.

[4] N. Y. Med. Jour., 1884, vol. 39, p. 562.

[5] Path. et Trait. d. Malad. d. la Peau (Traduction par Besnier et Doyon), 1891, tome 1, p. 839.

[6] Cutaneous Medicine, 1898, Part II, p. 447.

[7] Bd. xiii, S. 157.

[8] Arch. f. Derm. u. Syph., 1869, Bd. 1, S. 246.

[9] Ibid., S. 403.

the inclusion of both Auspitz and Kaposi's cases with pemphigus vegetans might be questioned. But there can be no doubt that Neumann had seen this form of pemphigus and had fallen into error. The patient whose condition he, as well as Hebra, regarded as luetic and whose case was published as such in 1876, was, he subsequently determined, a victim of pemphigus vegetans.

This patient was a lady thirty-one years old whom Politzer asked Neumann to see in January 1875. She was then complaining of great discomfort on swallowing. Her illness dated from the previous November when blebs appeared in the right axilla. Bursting, they left a raw moist surface on which granulations appeared. The mucous membrane of the lower lip, mouth, and fauces became affected so that the patient could take only liquid nourishment. The condyloma-like axillary vegetations led to a diagnosis of syphilis. Subsequently the vegetations appeared on the abdomen, in the groins, and over the labia majora. The various orificial mucosæ became affected.

The disease progressed steadily, other blebs, isolated and confluent, developing in the axillary region, on the chest, abdomen, and back. The exfoliation of the epidermis left raw surfaces like a burn of the second degree. There was considerable pain and the eruption exhaled a foul, almost unbearable odor. Uninfluenced by the remedies administered, the patient died, emaciated and exhausted, after an illness of four months' duration. The only comfort afforded the sufferer was the use of the full continued bath.

Before the patient died, it became evident that the condition was an independent affection uninfluenced by antisyphilitic treatment and in truth bore relation to the group of chronic pemphigus. Then Neumann recalled two previous instances in which the erroneous diagnosis of lues had been made and, together with six other examples, subsequently recognized and correctly interpreted, published his paper on the basis of these nine cases.

Almost simultaneously and independently Mr. Jonathan Hutchinson called attention to "A Form of chronic Inflammation of the Lips and Mouth which sometimes ends fatally and is usually attended by Disease of the Skin and Nails.[10]" With his characteristic accuracy of observation and recording he gives an account of several cases of ulcerative stomatitis with and without cutaneous eruptions to which his attention had been directed during the previous ten years. He points out that a question might arise as to whether all of them are of the same nature, and from our present knowledge it seems more probable that they are not similar. Yet, in the first group he recites the histories of two cases of pemphigus vegetans without assigning, however, a name to the affection. But, in a few words he shows clearly its distinguishing features and makes a surmise as to its relation to pemphigus. "The cases are important," he writes, "on account of their severity and from their close resemblance in some instances to syphilis" and again in portraying the eruption he describes "bullæ like those of pemphigus." He adds, "When the bullæ broke, papillary excrescences sprouted up from their base." Though Mr. Hutchinson gives such a clear representation of the disease, nevertheless it is Neumann's paper that has led to a general recognition of pemphigus vegetans. The French give him due credit by calling the affection "Maladie de Neumann." The subsequent history of the disease is contained in the publication and discussion of about fifty cases from which a survey of its features may be made.

Pemphigus vegetans is not a common disorder. In this country, J. Nevins Hyde is the only observer to report a case.[11] It is a disease of adult life and spares neither sex. The patient is in good health until attacked and neither the family history nor the occurrence of a previous illness throws light on the etiology. Mr. Hutchinson comments on the fact that his patients were residents of the country. Statistics drawn from the recorded cases regarding the occupations and residences of sufferers from pemphigus vegetans, cannot be compiled, for the published details are too meagre, but it is rather interesting to note that our patient, as well as Danlos and Hudelo's[12] were both farmers. In the discussion of the latter case, Brocq mentioned that he had seen the disease in a peasant and that there were "apthous cows" on the farm. The interpretation of these facts must, for the present, be left undecided.

The disease usually commences with soreness in the throat and mouth. In the present instance tiny pin-head-sized vesicles could be detected on the dorsum of the tongue, but owing to local conditions of heat and moisture, the blebs here do not long retain their form. Therefore, an examination usually reveals the mucous membranes of the mouth and fauces more or less eroded and partially covered with a yellowish pellicle of macerated epithelium. Hoarseness, pointing to an involvement of the laryngeal mucosæ, was the earliest symptom in our patient. In Ludwig's patient the preputial sac and urethra were first affected.[13] The conjunctiva may suffer and it is said that even the vaginal portion of the uterus and the rectum have been attacked. The affection of the mouth and throat is usually misinterpreted and it is only when the characteristic bullous eruption makes its appearance that the true nature of the condition becomes manifest. Occasionally this eruption marks the inception of the disease followed later by involvement of the mucous membranes.

The interval between the onset of the stomatitis and the appearance of the bullæ is usually one of days or weeks, but exceptionally, as in one of Köbner's cases, two years passed between the oral affection and the appearance of condyloma-like growths in the groins.[14]

The evolution of the eruption could be readily traced in the present case. Here the earliest lesion was a vesicle,

[10] Med. Chir. Trans., 1887, vol. lxx, p. 421.

[11] Jour. of Cutan. and Genito-Urin. Dis., 1891, p. 412.

[12] Ann. de Derm. et de Syph., 1900, tome 1, p. 1156.

[13] Deut. Med. Wochenschr., 1897, S. 267.

[14] Deut. Arch. f. Kl. Med., 1894, Bd. 53, S. 61.

the smallest being about 2mm. in diameter. Enlarging, a bulla somewhat lax and pendulous, and attaining a diameter of 1.5 to 2 cm., was formed. On opening the bleb, a clear, transparent, straw-colored serum exuded. In from two to three days the bulla began to exhibit yellowish points at its most dependent portion. The area of opacity having increased, the serous contents of the bleb finally became purulent. At this stage there developed a red areola about the lesion. Soon the thin layer of epidermis enclosing the pus ruptured and there was thus disclosed a red, raw, weeping surface partially covered by the collapsed epidermal wall. The adjacent patches now became confluent and the epidermis of the surrounding skin was lifted up so that the process spread in all directions, forming large areas many centimeters in diameter, at the periphery of which a ledge of epidermis, 2 to 5 mms. in width, remained adherent. In other places the true skin was not exposed but came to be protected by the formation of a thick, yellowish brown crust which, too, was fringed by the attached edge of the remains of the original bulla. Here as in the previous condition, an inflammatory halo encircled the lesion, giving the whole an ecthymatous appearance. Whether this crust formed or the tender surface became exposed, the end process proved the same. The last vestige of the dead epidermis disappeared and from the denuded surface there sprang a grey papillary outgrowth to a height varying with the location. On the arms and abdomen, where there was little mechanical irritation, it was not prominent, but in the axillæ and groins and over the back, regions exposed to friction, the papillary vegetating, condyloma-like character of the lesion was strikingly illustrated.

The cutaneous lesions may attack any portion of the body surface but the perigenital, axillary, umbilical areas and the regions bordering on the orificial mucosæ are seats of predilection. Except in the groins, pemphigus vegetans does not tend to show a symmetrical distribution.

In three of Neumann's cases the nails were affected, blebs appeared at their roots, the nails were discolored and lifted from their base by granulation tissue and pus. In a fourth case recently reported all the nails were the seat of such changes.[15]

In the present instance a small bulla as well as the vegetations was examined microscopically. The early lesions exhibited the signs of inflammation without any specific characters. With the exception of the layer of columnar epithelium the entire epidermis took part in the formation of the bleb's wall. The corium was the seat of a round-celled infiltration. The vegetations consisted of hypertrophied papillæ with their covers of stratified epithelium and their dilated blood vessels. Leredde and likewise Gastou have found eosinophiles in great abundance in the cellular infiltration of the epidermis. Such was not the condition in the present case.

Our bacteriological studies have been of interest. Cultures from the bullæ showed only the staphylococcus pyogenes aureus; but from the mouth and it may be added, from the blood after death a bacillus belonging to the pseudo-diphtheria group was grown in pure culture. This organism presented a similarity to the pseudodiphtheria bacillus which Waelsch has twice isolated from recent blebs and from the blood of two patients suffering from pemphigus vegetans.[16] Both our organism and Waelsch's exhibited irregular staining properties and polymorphism and both were pathogenic for guinea-pigs. There are these differences, however. Our bacillus did not stain by Gram's method while Waelsch's did retain its coloring. We could rediscover the organism in the blood of the dead guinea-pigs but in Waelsch's animals, the blood was sterile. In neither series of observations were changes resembling those of pemphigus vegetans found.

Aside from the condition of the mucous membranes and skin, pemphigus vegetans has no characteristic symptoms or signs. Itching is not a prominent feature, but the excoriation causes much pain and burning.

Irregular attacks of fever may usher in fresh eruptions or may occur independently.

Albuminuria and gastro-intestinal disturbances are not infrequent.

Leredde[17] lays great stress on the occurrence of an eosinophilia. In his own cases, as well as in one of Neumann's and Danlos and Hudelo's, the eosinophilic cells were augmented; in the latter, to six per cent. We noted particularly that in our own cases no such increase in eosinophiles occurred. The absence of eosinophilia in the present instance is significant in view of Coe's observations on its prognostic import in pemphigus,[18] his suggestion being that the presence of eosinophilia may betoken a more favorable outlook.

Symptoms referable to the nervous system have been occasionally described. In three of Neumann's patients, the tendon reflexes were exaggerated and two of them suffered from muscular contractures in the extremities. In the third, there was in addition ptosis of the right eyelid. A muscular tremor has also been noted by Herxheimer.[19] The patient in our care, exhibited a certain mental sluggishness. While under observation, he was somewhat stuporous, responding to questions slowly and only after the lapse of a noticeable interval of time.

The course of pemphigus vegetans is marked by a steadily progressing cachexia in spite of periods of marked amelioration in the condition of the mucous membranes and skin Indeed, the integument may assume an almost normal appearance and yet the sufferer may be separated from death by only a few days. Pneumonia, nephritis and intractable diarrhœa are the usual terminal events. The duration of the disease varies from a few weeks to fourteen months, usually less than a year. There are two reported exceptions to this statement. In both, the patients lived ten

[15] Ann. de Derm. et de Syph., 1901, tome ii, p. 869.

[16] Arch. f. Derm. u. Syph., 1889, Bd. 1, S. 71 and 78-100.

[17] Ann. de Derm. et de Syph., 1900, tome 1, p. 1161.

[18] American Medicine, June 28, 1902, p. 1092.

[19] Arch. f. Derm. u. Syph., 1896, Bd. 36, S. 141.

years after the inception of the affection. The first is the one seen by Neumann in Hebra's clinic and whose condition is briefly described and illustrated in Kaposi's [20] atlas. The other was reported by Köbner.[21]

It is the case of a man thirty-two years of age, who suffered in 1886 from blebs and ulcers over the mucous membranes of the cheeks and tongue. In 1888, condyloma-like growths uninfluenced by mercurial treatment were present in the gluteal region. For the next several years, the lesions in the mouth recurred. In 1890, the bullous eruption with papillary excrescences appeared in the groins. Treatment by curetting brought relief and he was said to be in good health in 1893. Two years later, the malady returned and death ensued after an illness of a year.

Thus it will be seen that the apparent recovery is only a respite, death is the ultimate result.

Post mortem no changes in the internal organs have thrown light on the nature of pemphigus vegetans. In one of Mr. Hutchinson's cases, a large lympho-sarcomatous tumor was found in front of the spine, imbedding the pancreas and large vessels. In our patient, a similar neoplasm was situated in the anterior mediastinum presumably having its origin in the thymus. In none of the other published autopsies were such tumors disclosed. The causal relation is, therefore, not evident, but it is proper that this coincidence between Mr. Hutchinson's case and the present one should be indicated.

The nervous structures have been repeatedly studied in the hope of throwing light on the origin and nature of the disease. Unfortunately, examination of the brain and cord of our patient was not permitted. The first, second, and third dorsal spinal ganglia were excised, however. They exhibited no gross alterations. Microscopically, the ganglion cells showed interesting changes, the chief of which consisted in a marked increase of pigment. Some cells were three-fourths occupied by the pigmented granules while many showed one-half the cytoplasm thus replaced. Others presented signs of degeneration in that the outline of the nucleus was wanting and the nucleolus had become indistinct. Marianelli [22] has also observed this hyperpigmentation in the cells of the upper cervical ganglia of the sympathetic, and degenerative changes similar to those just described but having their seat in the cells of the anterior cornua and Clarke's columns have been noted in a case of pemphigus vulgaris by Brochieri.[23] These alterations have probably no bearing on the causation of pemphigus vegetans; indeed, they are doubtless, as Köbner points out, secondarily dependent on the toxæmia of the disease.

It follows then that neither bacteriological nor pathological studies [24] have furnished means of identification and the diagnosis of the disease must rest on its clinical aspect and course. Fully developed, the affection has been most frequently mistaken for syphilis. "Though the patient's morals," writes Neumann, "were thus indicted, on the other hand, the hope of recovery was held out to him." [25] To be saved from such an error, the diagnosis becomes a matter of importance.

The elementary bullous eruption, should, when present, lead to a recognition of the pemphigoid nature of both the vegetations and the lesions of the mouth. If the blebs have been effaced, subsequent efflorescences alone or together with the stomatitis, should make the diagnosis clear. Aside from the bullæ, the superficial nature of the excoriations and certain characteristics of the vegetations serve to differentiate pemphigus vegetans from syphilis. The former grow rapidly and the remains of the bleb may be detected at the periphery of the vegetations; the border of a condyloma is firm and indurated. Neumann also calls attention to the stippled appearance of the vegetations as opposed to the uniform deposit which may cover a condyloma. Finally, the absence of a history of lues, the fact that other evidences of syphilis are wanting, and the injurious effect of antisyphilitic treatment, which was noted in our patient as well as in other of the recorded cases, these data contribute to establish the correct diagnosis of pemphigus.

Little need be added to what has already been said regarding the differentiation of the other members of the pemphigus group from pemphigus vegetans itself. It is well known that they may exhibit, at rare intervals, vegetating lesions. Indeed, in Grouven's case of pemphigus vegetans the lesions at the onset were those of the common and exfoliating types and only the subsequent course led to the diagnosis of pemphigus vegetans.[26] Hallopeau and Leredde [27] believe that the mode of development of pemphigus vulgaris, as well as of dermatitis herpetiformis, differentiates these disorders from Neumann's disease. Here they do not present the asymmetry of pemphigus vegetans. Neither does a single bulla, as in the latter disorder, by its eccentric extension, come to involve a considerable area of skin. Lastly, they point out the favorable influence of local treatment on the cutaneous manifestations of pemphigus vegetans as contrasted with its usual failure in dermatitis herpetiformis and pemphigus vulgaris.

There are a number of other dermatoses complicated by disease of the mucous membranes and vegetating lesions which have led to confusion with pemphigus vegetans. The disorder which Hallopeau regards as the pustular variety of Neumann's disease, should, in all probability, be set aside as a distinct condition. Its pustular character, the group-

[20] Die Syphilis d. Haut u. der angrenzenden Schleimhäute, 1875, III Lieferung, Tafel LXIII u. LXIV.

[21] Loc. cit.

[22] Giorn. ital. delle Malat. vener. e della Pella, 1889.

[23] Giorn. ital. delle Malat. vener. e della Pella, 1898, anno xxxiii, p. 371.

[24] For studies on the metabolism see Stüve, Arch. f. Derm. u. Syph., 1896, Bd. 36, S. 191, and Giovanni, Gior. ital. delle Malat. vener. e della Pella, anno 33, 1898, p. 354.

[25] Loc. cit.

[26] Arch. f. Derm. u. Syph., 1901, Bd. 55, S. 423.

[27] Traité pratique de Dermatologie, 1900, p. 734.

ing of the lesions and its more benign nature (only two of the five patients died) contrast with the essentially bullous character and the hopeless outlook of Neumann's disease. Tommasolli[28] has persistently insisted that the term "pemphigus vegetans" has been used to cover a multitude of conditions some of which have no evident relation to pemphigus. He has proposed to designate them all as condylomatosis pemphigoides maligna, thus abandoning the title of pemphigus vegetans. This procedure is not justifiable. On the other hand, there can be no doubt that as pemphigus vegetans at least two conditions have been on several occasions described and confused; the disease which Neumann distinguished and another to which Hallopeau's dermatosis belongs, a condition characterized by vegetations but where the bullous or vesicular lesion is absent or plays such an insignificant role that for the present it may be excluded from the pemphigus group.

The pustular character of impetigo herpetiformis, too, should differentiate it from pemphigus vegetans. The frequent association with pregnancy is an assistance in the diagnosis of impetigo herpetiformis as well as in the recognition of other cutaneous disorders occurring in this state.

Finally, the rare examples of drug eruptions, such as Hallopeau[29] describes as following the use of iodide of potassium though combining disease of the mucous membranes with cutaneous vegetations, may be distinguished by the attendant circumstances and the subsequent course.

We have now discussed the diagnosis of pemphigus vegetans when the disease is presented in its entirety. The superficial resemblance to syphilis has been emphasized. At the onset, with the lesions localized in the mouth and throat, a confusion with lues is likewise possible and the failure of antisyphilitic treatment or the appearance of the cutaneous efflorescence may first indicate the error in diagnosis. Seldom, however, does one see mucous patches so extensive as the initial stomatitis of this variety of pemphigus while occasionally, as in our patient, the occurrence of intact vesicles on the mucous membranes, raises a suspicion of the true nature of the disorder.

The unusual "epidemic stomatitis" or "foot and mouth disease," communicated by cattle, is also accompanied by a vesicular eruption in the mouth and fauces but the demonstration of the source of infection, the hemorrhagic tendency of the disease and its usually favorable course are guides to its recognition.

At rare intervals there are encountered in adults examples of severe stomatitis of unknown origin, such as Mr. Hutchinson has described in the paper to which we have referred. These bear, in all probability, no relation to pemphigus. The possibility of Neumann's disease should ever be held in mind and a careful and repeated search for the ill-omened bulla be made. Mr. Hutchinson's patients recovered under a treatment to be presently mentioned.

It may be gathered from the foregoing statements as to the grave nature of the disease that treatment is limited to assuaging the suffering of the patient. General medication is without effect. Arsenic is valueless, mercury and iodide of potassium are harmful. The efforts of Waelsch to develop a treatment based on a possible etiological factor are worthy of note. After isolating the pseudodiphtheria bacillus from his two cases and finding that diphtheria antitoxin apparently immunized animals, he was led to use the antitoxin on his second patient as a therapeutic measure. While the patient was receiving this treatment, the animals having survived forty to forty-four days, died, and it became clear that the protection was temporary or apparent. The attempt to obtain an antitoxin for the particular organism under consideration was now made, but the patient succumbed before the necessary material could be gathered.

Another therapeutic suggestion has come from Mr. Hutchinson. In those cases of severe stomatitis which bore a resemblance to the buccal disorder of Neumann's disease opium was administered and under its use the lesions healed. But, in no case of undoubted pemphigus vegetans, has opium been fairly tried at the beginning of the malady. One is therefore justified in exhibiting opium in any unusual case of stomatitis, even before a definite diagnosis is established.

Although nothing alters the fatal tendency of the disease, the cutaneous lesions are favorably influenced and the discomfort of the sufferer is greatly diminished by the continuous use of the full bath. Under this treatment, the excoriations over the back, neck and arms of our patient healed and there was obtained a degree of comfort which the previous applications of lotions, ointments and powders failed to give.

The state of the mouth necessitated the use of liquid and soft food while rinsing with a hydrogen peroxide wash was continued.

After all has been said, the nature of this malady remains obscure. The prevalent view is that the immediate cause is some infection or intoxication. Perhaps subsequent investigation may prove a causal relation between the pseudodiphtheria bacilli which Waelsch and we have isolated and place pemphigus vegetans in the category of infectious diseases. But, the disease is not contagious and in addition to a specific organism some predisposing factor must be assumed. With the presence of an eosinophilia in some cases as a basis, Leredde has suggested that a latent alteration in the hæmopoietic apparatus predisposes certain individuals to the immediate cause, whatever it may be. Such an hypothesis is extravagant. Analogy like that offered by the eosinophilia of trichinosis teaches that an increase in these cells is the result of an intoxication or infection and offers no evidence as to the previous state of the blood-forming organs.

History.

Mr. E. M., farmer, married, age fifty-two years, was admitted to the Johns Hopkins Hospital, in the service of Dr.

[28] Arch. f. Derm. u. Syph., 1898, Bd. 44, S. 325.

[29] Op. cit., p. 635.

Osler, February 6, 1901. He complained of a skin eruption and sore mouth.

Family History.—Mother died of "consumption." Father died of "stomach trouble." A sister died of "consumption." A sister is living and suffers from asthma. Four maternal aunts have died of "consumption." There is no history of new growths nor is there any account of a trouble similar to the present in the family.

Past History.—Measles and whooping cough as a child. At the age of twenty to twenty-five, he had a skin eruption which was said to be due to "poison oak." Subsequently he had several attacks.

At twenty-seven years, he was overcome by the heat; since then he has been susceptible to the sun's rays, having on several occasions suffered from vertigo after exposure.

Ten or twelve years ago, he had an eruption on the wrist; it itched and was pronounced eczema.

About five years ago he became nervous and weak and since then has not been able to do hard work.

He suffered from shaking chills two years ago.

Until four years ago, he chewed tobacco a great deal. He has never smoked to excess. He seldom drinks beer or whiskey.

He denies all venereal diseases.

Present illness began in January, 1900, with hoarseness. At about this time he suffered from a sore mouth. Little ulcers appeared on the lips, tongue and on the inner surface of the cheeks. They originated, he asserts, in little "blisters." Just before the onset of the sore mouth he had a scabby eruption on the legs which he attributed to "red bug bites."

In less than a month after the beginning of his illness an eruption commenced in the left groin. It was diagnosed eczema and under treatment apparently disappeared. Then a similar eruption appeared in the right groin; it itched a little. The same treatment was used but it was of no avail and the disorder reappeared in the left groin. It gradually grew worse and spread. It became so bad that the patient could not move about. The mouth and throat continued sore at intervals. In June, he commenced to expectorate a clear saliva which ran from the mouth night and day. In September, the disease was called syphilis and he was given the appropriate treatment by mouth and by inunctions. After this treatment the condition of the mouth grew worse, that of the groins seemed better. Two weeks ago yellow blisters appeared on the arms and the condition of the skin over the back grew worse. This eruption, the patient states, is entirely different from the "red bug bites" which were originally on the legs.

His general condition has become gradually worse. He has difficulty in chewing and swallowing. Bowels are regular. He has lost seventy-five to eighty pounds in the past twelve months.

Physical Examination.—The patient is a sparely nourished man. Mucous membranes are of fairly good color.

The patient is constantly expectorating a turbid, foul smelling tenacious sputum. The mouth presents a remarkable appearance. The vermilion of the lips is excoriated and irregularly covered by a whitish pellicle of macerated epithelium suggesting the mucous patches of syphilis. The tongue is covered with a yellowish white coating. Its dorsum is cracked and excoriated. Here and there on careful inspection tiny pin-head sized vesicles can be discovered. The mucous membranes of the lips, cheeks and fauces present the same white macerated and excoriated appearance just described.

With the exception of the palms, soles and scalp, no part of the body surface is entirely free from lesions. At the outer canthus of the right eye there is an excoriation about 1 cm. in diameter the edges of which are formed by overhanging epidermis suggesting the remains of a bulla. The surface is bathed with a purulent fluid. A dirty brown crust is situated over the lobule of the right ear and a foul smelling purulent discharge exudes from this external auditory meatus. The lips are covered with yellow honeycomb-like crusts. The right nostril is partly plugged by hard brown crusts and a discharge of pus comes from it.

Scattered over the neck, arms, axillæ, flexures of the elbows, forearms, back, abdomen, legs, and groins the lesions are distributed in various stages of evolution. The earliest change is evidently the formation of a vesicle or bulla. These lesions are present in the lumbar region, in the right axilla and flexure of the elbow and in the right groin. There are about one-half dozen of them. They vary in size from that of a lentil to that of a thumb-nail, are flaccid, discrete and the skin about them is unchanged. Here and there are bullæ of about the same size which have in their dependent portions a turbid yellow fluid.

The greater number of lesions are excoriations varying in size from about ½ to 8 cm. in diameter. They are discrete and confluent. Over the lumbar region they have come to form a large irregular patch about 20 by 10 cm. in size. The base of these excoriations is bright red and weeping; the border is formed by a ledge of epidermis. These characteristics are particularly well marked over the back. Some of the excoriations, as over the abdomen, are covered with large yellowish brown impetigo-like crusts and are surrounded by a red halo. Scattered among these lesions are tiny papulo-pustules evidently due to secondary infection.

The inguinal and perigenital regions are the seat of unusual changes. The groins are occupied by elevated greenish brown, foul-smelling excrescences about 10 by 20 cm., in diameter. The surface is crusted and cracked; closer inspection reveals its papillary character. The same lesion extends along the lateral aspect of the scrotum and posteriorly as far as the anus. Irregular patches of pigment are seen on the shins.

The nails of the left hand show deep transverse ridges about their centres.

The lungs exhibit the physical signs of emphysema; examination of the heart is negative. The abdominal exami-

nation is negative. The sputum does not contain the tubercle bacillus. The urine varies in specific gravity from 1010 to 1020, is acid, contains neither albumen nor sugar and does not give the diazo reaction. Microscopically, the sediment shows large sheets of epithelium.

Examination of the fæces yielded no noteworthy results.

The blood: hæmoglobin, 85%. Red blood corpuscles, 4,212,000. White blood corpuscles, 13,500.

Treatment and Progress of the Condition.

The patient was given soft and liquid food and Fowler's solution m. vi, was administered three times a day. About two weeks after admission to the hospital, he was placed in a tub bath. While under this treatment, the condition of the skin showed an improvement although fresh lesions appeared from time to time. Thus, the left eyelid became involved, there was a profuse purulent conjunctivitis but eventually these signs disappeared. From practically all the excoriations pigmented papillary excrescences developed as the healing process took place. About the neck and over the upper half of the sternal region, parts not covered by the water, the excoriations failed to heal. The papillary growths in the groins were not so prominent.

The condition of the mouth and throat varied from time to time, but on the whole became more and more involved so that even the swallowing of liquids caused great pain.

The temperature was elevated and irregular, ranging, as a rule, from 99° to 99.7°, only on two occasions going above 102°.

The patient lost weight continually, became very much emaciated, his mind wandered, the signs of a broncho-pneumonia developed on March 10, 1901, and he passed away the following day after an illness of about fourteen months.

Autopsy.

The privilege of investigating the brain and spinal cord was withheld. The autopsy confirmed the diagnosis of of broncho-pneumonia and emphysema. The condition of the spinal ganglia has already been noted.

In the anterior mediastinum there was a firm nodular yellowish white mass firmly adherent to the pericardium. It measured 18.5 by 7 cm. On section, the tumor was firm and gritty. It was found to be lobulated and composed of a translucent pale pink tissue striated with fine white lines. Microscopically, it consisted of irregular masses of tissue containing nuclei closely packed together and separated by compact strands, often rounded columns of dense fibrous tissue relatively poor in fibroblasts. The former tissue cells possessed nuclei either of the lymphoid or fibrous tissue type.

With the exception of the skin and lungs all other organs were normal. There was no ulceration in the gastro-intestinal tract or in the bladder.

Bacteriology.

Cultures taken from the blebs are either negative or show the presence of the staphylococcus aureus. Cultures from the mouth reveal the presence of a small bacillus in almost pure culture. In bouillon media it occurs in chains and groups of two. It is not motile, stains irregularly, particularly with Neisser's reagent. There are a number of irregular forms. It does not stain by Gram's method.

On agar it forms a moist, greyish white film with abrupt finely serrated edges.

Gelatine is not liquified.

No gas is formed in glucose agar.

On potato the growth has a faint yellowish hue and is moist.

In bouillon there is a heavy flocculent sediment with white particles in suspension.

Litmus milk shows no change at the end of twenty-four hours but in forty-eight hours it is paler but not coagulated.

The indol reaction is not given.

On October 8, 1901, both a guinea-pig and a rabbit were inoculated subcutaneously with a sixteen hour bouillon culture of the organism. The former received fifteen minims, the latter twenty-five minims.

The rabbit at the time of inoculation weighed 850 grms. It steadily lost flesh after the injection; on October 26, eighteen days after its inoculation, it died, weighing 620 grms. At autopsy nothing abnormal was found except slight congestion of the kidneys, spleen and liver. Cultures were taken from the heart's blood and a pure culture of the organism injected previously was obtained.

The guinea-pig weighed 230 grms. on October 8; it too lost flesh steadily and succumbed on November 1, twenty-four days after inoculation, having lost eighty grms. On section nothing abnormal was found. Cultures were taken from all the organs. From the heart's blood the original organism was isolated in pure culture.

The organs of these animals were carefully examined microscopically but no lesions were demonstrable.

The organism we were dealing with, no doubt belongs to the pseudodiphtheria group.

After the death of our patient, the micrococcus lanceolatus was isolated from the lungs; a pseudodiphtheria bacillus, from the blood.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

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FIG. 1.—The prominent vegetations in the groin are here depicted. Two of the impetigo-like crusts are seen on the abdomen.



FIG. 2.—The illustration shows lesions on the back. Most of them are excoriations, about the borders of many the remains of the vesicle can be seen. One of the large crusts can be seen in the infrascapular region on the left side.

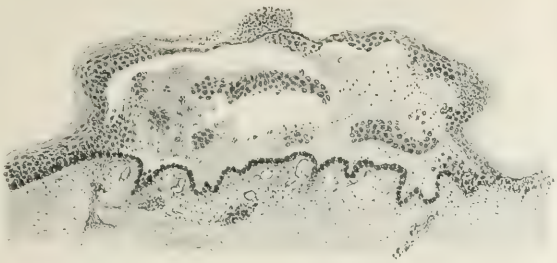


FIG. 3.—Represents the earliest lesion described, the vesicle. It will be seen that serum has accumulated in the stratum mucosum and has lifted up the greater part of that layer, leaving the columnar cell layer still attached to the corium. Here and there groups of polygonal cells have also remained adherent to the true skin.

The portion of the epidermis forming the walls of the vesicle is thinnest at the summit of the bleb, where it is made up of but two layers of flattened cells; from this point toward the margin the layers become more numerous until the entire normal thickness is reached.

Great numbers of leucocytes, especially the polymorphonuclear, are seen both within the vesicle and upon its surface. The contents of the bleb consist mostly of serum, leucocytes and epithelial cells in various stages of degeneration.

In the framework of the corium, especially about the blood vessels, there is marked round-cell infiltration, but here and there are groups of neutrophiles. In almost every papilla two or three dilated capillaries are found distended with blood.



FIG. 5.—This represents one of the papillæ magnified. Here the loose structure of the stroma is clearly seen. Here and there scattered in the connective tissue are white blood corpuscles, for the most part polymorphonuclears.

An enlarged capillary filled with blood extends the whole length of the papilla and occupies about one-fourth of its entire width. One or two layers of columnar cells are seen on the surface.

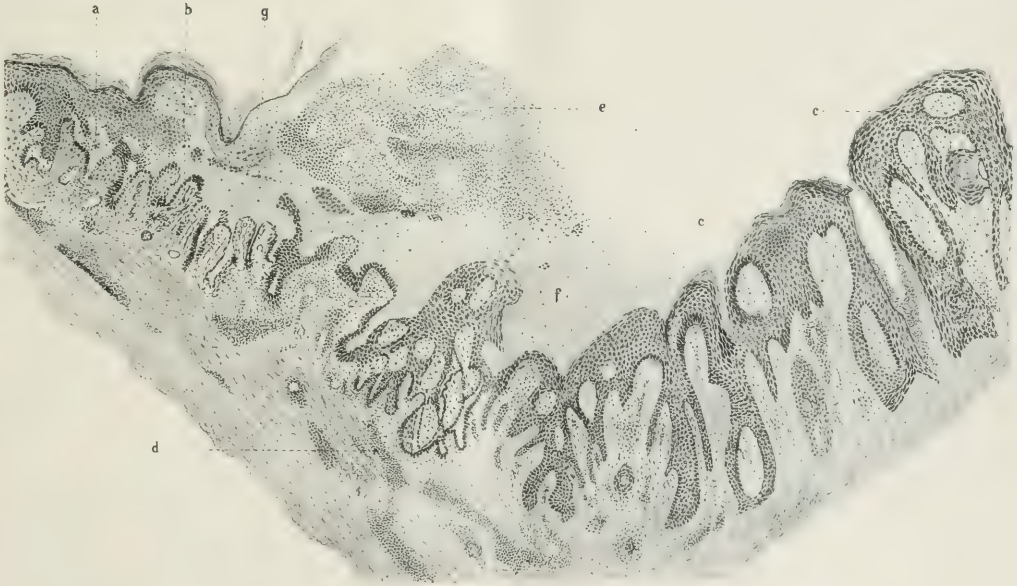


FIG. 4.—Represents the lesion at its most advanced stage and yet, it illustrates, too, many of the stages described in the clinical advancement of the disease.

Beginning at the left we see where the epidermis is lifted off from the papillæ (a), forming a shelf of epidermis (g). This is the remains of the covering of the vesicle. At its attached portion, to the extreme left, it approaches closely normal skin, but it gradually becomes more lifeless in appearance towards its free end until it is finally just a mass of necrotic cells at the point where the rupture has occurred.

Between this ledge and the papillæ of the corium are some of the remains of the vesicle contents plus the exudate from the papillæ. Here we find masses of necrotic epithelium, and great aggregations of leucocytes (e) floating in serum (f).

The papillæ at the margin of the lesion are increased in number and are higher and more irregular than normal. Here they are covered by usually one, but in many places several, layers of stratified epithelium that were left behind when the upper layers of epithelium were raised to form the vesicle.

The stroma of these papillæ is made up of very loosely arranged connective tissue in which many leucocytes that have wandered out from the vessels are seen. In almost every papilla are found one or more dilated capillaries filled with blood. (See Fig. 3.)

These vessels are extremely close to the surface, and so the weeping, red, raw appearance of the lesion is readily explained.

As the lesion becomes older the papillæ increase in size and become covered with many layers of stratified epithelium which has developed, no doubt, from the cells left behind in the formation of the original vesicle. It can readily be seen that this tremendous increase in the size of the papillæ accompanied by the hyperplasia of the epithelium would give the condylomatous, vegetating appearance described in the clinical picture. In these large papillæ the capillary dilatations are no longer so evident, but the stroma is still loosely arranged and shows a fibrillary structure.

In the connective tissue framework and about the blood vessels of the corium are great numbers of round cells (d).

THE TASTE FIBRES AND THEIR INDEPENDENCE OF THE N. TRIGEMINUS.

DEDUCTIONS FROM THIRTEEN CASES OF GASSERIAN GANGLION EXTIRPATION.[1]

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Were it a subject which lends itself readily to methods of experimental research the course of the taste fibres from their special sense terminals to the medulla would long since have been established. Unfortunately, the solution of this mooted question has hinged largely upon the study of clinical cases in which as a result of morbid processes or of traumatism, paralyses have involved, singly, one or another of the nerves supposed to carry these centripetal impulses. Owing to the rare possibility of an accurate determination of so slight an intracranial lesion, at or near the time when the examination for taste has been made, the interpretations have been so conflicting that impartial observers have been led to believe that there is considerable individual variation in the course of these fibres, especially centrad to the Ganglion geniculatum. On purely anatomical grounds such a variation would seem improbable, and if untrue, is to be regretted, since the symptom of ageusia may be of considerable moment in the diagnosis and localization of intracranial processes.

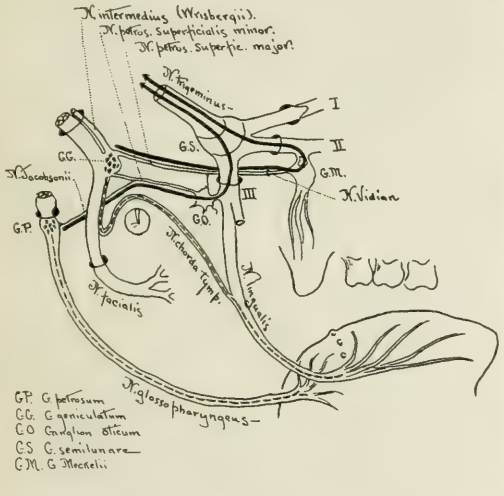


Fig. 1.—Diagram of the nerves commonly advocated as routes for taste transmission. Undoubted paths from tongue to G. petrosum and G. geniculatum are indicated by broken lines. Commonly advocated paths via the N. trigeminus to the brain indicated by heavy black lines with arrows.

Opinion is almost unanimous concerning the path traversed by the impulses from the anterior two-thirds of the tongue for a certain distance. As the diagram (Fig. 1) shows, they accompany the lingual nerve to its bifurcation; thence they pass by the Chorda tympani to enter the aqueduct of Fallopius, and from this point in company with the N. facialis to the geniculate ganglion.

How the fibres reach the brain in their further progression is undetermined. The chief weight of authority favors a most circuitous route by the great superficial petrosal and Vidian nerves to Meckel's ganglion, thence to the superior maxillary division of the trigeminal nerve, the ganglion of Gasser and to the brain by the N. trigeminus itself.

Another possibility, which morphological studies seem to favor, is a more direct course by way of the N. intermedius (Wrisburg) in company with the facial. It is, however, commonly stated, although the evidence seems rather circumstantial, that a pure intracranial lesion of the N. facialis (the portio intermidia presumably being included) is unaccompanied by any impairment in the perception of taste; and this is one of the chief arguments adduced in favor of the view that the N. trigeminus harbors the paths for these fibres. A similar intracranial lesion of the N. glossopharyngeus, which nerve undoubtedly conveys sensations of taste from the posterior third of the tongue and possibly from the palate (?), fauces and epiglottis as well, is also said to be unassociated with loss of taste over this territory, and the fibres from this region have, in consequence, been accredited by many with a correspondingly devious course to the N. trigeminus by way of Jacobson's nerve to the lesser superficial petrosal, Otic ganglion and mandibular or IIId division of the fifth nerve.[2] (Cf. Fig. 1.)

[1] Presented at the meeting of the American Physiological Society held in Washington, December 31, 1902.

[2] It would carry one too far afield and out of the province of this paper to discuss the numerous paths which, according to the views of one or another, are supposed to be followed by the gustatory impulses. Some of the more strongly supported claims are the following:

Fibres from the anterior portion of the tongue are supposed to pass by the devious route mentioned in the text to the IId division of the Vth nerve, (Erb, Schiff, Gowers, *et al.*); to the IIId division of the same nerve via the Otic ganglion (Ziel, Müller, *et al.*)

Fibres from the entire half of the tongue, anterior and posterior, pass to the brain by the Vth nerve, the glossopharyngeal fibres reaching the lesser superficial petrosal Otic ganglion and the IIId division of the Vth via the delicate nerve of Jacobson as described (Gowers, Turner, *et al.*)

Detailed reports of cases of cranial nerve lesions with partial or complete paralysis of the N. trigeminus accompanied by loss of taste on the corresponding side of the tongue have appeared in medical literature in considerable number during the past twenty years. The cases reported by Erb,[3] Gowers,[4] Salomönsohn,[5] Scheier,[6] Schmidt,[7] Ziehl [8] and Kron [9] may be mentioned among some of the more important and carefully studied clinical cases of this sort. In all of them the authors were led to the view that the taste fibres must pass to the brain in whole or in part by way of the fifth nerve. Although there are a few recorded cases such as those of Lussana and Renzi, of Lehmann,[10] Cassirer [11] and of Bruns [12] which contrariwise seem equally convincing, clinical experience on the whole seems to favor the trigeminal route of transmission. In very few, if any, of these cases, however, has it been possible to demonstrate by a post-mortem examination the isolarity of the lesion,[13] and the strongest advocates of this view acknowledge, as does Turner,[14] that the evidence derived from them leads to confusion as to the particular branch of the Vth which contains the taste fibres, whether the N. maxillaris or N. mandibularis.

It would seem that the established operation for removal of the Gasserian ganglion in cases of trigeminal neuralgia, or simply the intracranial section of the second and third divisions of the N. trigeminus, would be the equivalent in man of an accurate physiological experiment and would long since have determined with finality the part which the fifth nerve plays in the transmission of gustatory sensations. Curiously enough, however, the results of observations upon these operated cases heretofore have only led to greater confusion, owing to their apparent lack of uniformity. The evolution of the operation since the earlier unsatisfactory attempts at extirpation has at the present time rendered it possible in most cases to remove the ganglion in toto with inconsiderable difficulty, and several surgeons of experience have published their personal series of cases. Although largely reported from a surgical standpoint to the neglect of post-operative observations concerning the resultant paralyses, nevertheless some of these papers are not silent on the subject in question.

First of all Krause, in the six cases examined and reported in his classical monograph,[15] seems to have had variable results, although in no instance was there a complete abolition of taste perception. In one case on the 20th day "sweet" was the only form of taste recognizable and that tardily in comparison with the normal side. In other instances, taste although present to all forms of stimuli was diminished in acuity. In one case there was absolutely no alteration whatever. This positive finding he regards as

Fibres for the entire half of the tongue may ultimately pass by way of the glossopharyngeal through anastomoses between the Chorda tympani and Jacobson's nerve. (Cassirer, Carl, Brücke and Hermann, *et al.*) Observations made upon cases of middle ear disease are claimed to evidence passage of fibres by way of the Plexus tympanicus.

All fibres pass direct to the brain by way of the Portio intermedia (Lussana, Dixon), et cetera, et cetera.

It can be seen that impulses are supposed to travel in one direction or the other along the N. superfic. petros. major and minor and the N. Jacobsonii according as the reporters have found such a course necessary to conform with the supposed demands of the particular clinical picture. The embryological development of the nerves as indicated by His should show in what direction the impulses really pass. Dixon alone has touched upon this point. For an earlier discussion of the question see v. Vintschgau's chapter in Hermann's Handbuch der Physiologie, vol. iii, Zweiter Theil, 1880, p. 164, III. Die Geschmacksnerven. Also later, cf. v. Frankl-Hochwart, Die nervösen Erkrankungen des Geschmacks u. s. w., Wien, 1898.

[3] Erb, Ueber den Weg der geschmackvermittelnden Chordafasern zum Gehirn. Neurologisches Centralblatt, 1882, Bd. i, s. 73, s. 104.

[4] Gowers, A case of Loss of Taste from Disease of the Fifth Nerve. Journal of Physiology, 1880, vol. iii, p. 229. Also Diseases of the Nervous System, ed. II, vol. 2, p. 224, "Affections of Taste."

[5] Salomonsohn, Ueber den Weg der "Geschmacksfasern" zum Gehirn. Inaugural-Dissertation. Berlin. März, 1888. Ref. Neurolog. Centralbl., 1888, Bd. vii, s. 295.

[6] Scheier, Beitrag Zur Kenntniss der Geschmacksinnervation, u. s. w. Zeitschrift für klin. Med., 1895, Bd. 28, p. 441.

[7] Schmidt, Ein Fall vollständig isolierter Trigeminuslähmung-Deutsche Zeitschrift für Nervenheilkunde. Bd. vi, s. 438.

[8] Ziehl, Ein Fall von isolierter Lähmung des ganzen dritten Trigeminusastes, etc. Virchow's Archiv, 1889, Bd. cxvii, p. 52, and 1889, Bd. cxxx, s. 528.

[9] Kron, Ein Beitrag zur Lehre über den Verlauf der Geschmacksfasern, Neurologisches Centralblatt, 1901, Bd. xx, s. 549.

[10] Lehmann, Ein Beitrag zur Lehre vom Geschmacksinn. Pflüger's Archiv für Physiologie, 1884, vol. xxxiii, p. 194. A case of traumatic lesion of the VII, VIII, IX and XII nerves with complete loss of taste on corresponding side of tongue.

[11] Cassirer, Ein Fall von multipler Hirnnervenlähmung. Zugleich als Beitrag zur Lehre von der Geschmacksinnervation. Archiv f. Anat. u. Physiol., 1899. Supplement-Band, s. 36. A traumatic case of paralysis of the IX, X, XI and XII nerves with complete loss of taste on the corresponding half of the tongue. The uncertainty of deductions from clinical cases well evidenced by the author's excellent historical presentation.

[12] L. Bruns, Multiple Hirnnervenläsion nach Basisfractur. Archiv für Psychiatrie, 1889, Bd. xx, s. 495. Bruns' case is doubly striking inasmuch as there was a complete paralysis of the Vth nerve on one side without loss of taste and a lesion of the VII nerve on the opposite side associated with symptoms of ageusia.

[13] One of the cases on which considerable stress is laid in the English literature as bringing convincing evidence of these views is that reported by Ferguson (The Nerve Supply of the Sense of Taste. Medical News, Phila., 1890, vol. 57, p. 395).

Gowers, Turner and Stewart quote this case as furnishing conclusive support to their belief. Ferguson examined post-mortem a patient in whom loss of taste, lasting over a period of 18 months, had previously been demonstrated on one side of the tongue. A small exostosis was found compressing the Vidian nerve and the reporter claims to have demonstrated degeneration of the nerve passing from the point of compression into the superficial petrosal, facial, chorda tympani, and lingual nerves. No mention is made of any histological demonstration of evidence of degeneration nor are the methods of studying what must have been a most difficult and arduous problem, even suggested In view therefore of the isolarity of this case and of morphological studies which show that the superficial petrosal is an outshoot of the G. geniculatum, the observation hardly deserves the keystone position which it has been given.

[14] W. A. Turner, Allbutt's System of Medicine, 1899, vol. vi, p. 793.

[15] Die Neuralgie des Trigeminus, Leipzig, 1896. Geschmacksempfindung, p. 82.

more important than all others and it is interpreted as an indication that the trigeminus possesses no taste fibres.

The information gained from other cases has been regarded as similarly inconclusive. Those of Tiffany,[16] Finney[17] and Lynn Thomas[18] are often quoted and, like Krause's, used as an argument pro or con indiscriminately by those ranged on both sides of the question.

Taste was examined by Dr. Thomas in two of Finney's cases and found to be absent in one and present in the other. In Tiffany's series also taste was absent in one case, present in another (4 months after operation) and uncertain in a third.

In two of the cases reported by Friedrich[19] examination showed a complete post-operative anæsthesia, analgesia and ageusia over the anterior two-thirds of the tongue. Taste before the operation had been examined and found to be normal. Köster in his recent admirable paper[20] published two years after Friedrich's report says that in one of these cases taste had completely returned to a condition equal to that on the normal half of the tongue. Anæsthesia to other forms of sensation still persisted. Believing as he does in the Vth nerve route of transmission from the "Chordagebiet" he accounts for this return of taste by the establishment of a collateral innervation on the side of the IXth nerve.

In the cases reported by Keen, Horsley, Lexer and others, all of whom have had a wide experience with the ganglion operation, the strictly surgical aspect of the extirpation is dwelt upon rather than its post-operative physiological sequelæ. Sir Victor Horsley is credited by Gowers with the statement that in the private cases operated upon by himself in which he afterwards tested the sense of taste he found it lost in each instance.

It is noteworthy that Sherrington[21] has experimentally made intracranial section of the trigeminal nerve and in one of his classical papers says that in the monkey, after section of the fifth cranial nerve, he has always failed to find evidence of persistence of any sense of taste in front of a line a few millimeters anterior to the circumvallate papillæ. Experimental observations with similar results were made by Schiff after removal of the ganglion in dogs.

It is no matter for surprise that those who have had the opportunity of studying cases after extirpation of the Gasserian ganglion in man have satisfied themselves with occasional or indeed isolated tests relative to the preservation or loss of the sense of taste. The observations are tedious, difficult both in performance and interpretation and like the study of other sensory phenomena are quickly a source of fatigue to the patient. There are, furthermore, so many other demands for post-operative notes upon these patients that unless especial attention is given to one particular point, it is apt to be superficially gone over.

Sir Wm. Gowers[22] in a recent article gives the only report of observations on the long series of cases which have been operated upon by Horsley and Ballance. Seemingly only five of these cases have been critically examined for taste, and according to Gowers' report in only one of them was it not abolished. Its preservation in this particular case is accounted for by the fact that the extirpation was supposed to be an incomplete one, for though taste perception was found to be present soon after the neurectomy, it subsequently disappeared. The examinations were made in these cases ten weeks, nine months, five weeks and four weeks respectively after the operation, and the statement is made that there was complete unilateral loss of taste *on the front and back of the tongue* in each instance. Owing to these observations, as well as to his earlier experience in cases of disease involving the Vth nerve, with accompanying loss of taste, Gowers champions almost without reservation the transmission of these impulses by way of the N. trigeminus not only from the Chorda territory on the front of the tongue, but from that part as well which is presided over by the N. glossopharyngeus.

Purves Stewart in a recent excellent text-book[23] expresses the matter in these words, * * * "it is highly probable that all the taste fibres enter the brain through the Gasserian ganglion, for when the fifth nerve is divided by operation in man, above the Gasserian ganglion, although the glossopharyngeal nerve remains untouched, there is total loss of taste on the whole of the affected side."

The writer's observations, which have covered a larger number of cases and which have given practically uniform results, are completely at variance with Gowers' findings and with this opinion as expressed by Stewart. In the first place, disturbances on the portion of the tongue presided over by the N. glosso-pharyngæus as the result of ganglion extirpation may be dismissed with a word. No interference whatever with taste perception posterior to the circumvallate papillæ has ever been observed, nor can I find that this has been the experience of others.

Gowers mentions as a possible source of fallacy from early observations after ganglion extirpation that taste may seemingly be preserved for a time owing to a terminal communi-

[16] Tiffany, Intracranial Neurectomy and Removal of the Gasserian Ganglion. Annals of Surgery, 1894, Bd. 19, p. 47.

[17] Finney and Thomas, Three Cases of Removal of the Gasserian Ganglion. Johns Hopkins Hospital Bulletin, 1893, vol. iv, p. 91.

[18] Lynn Thomas, Notes on Two Recent Operations upon the Gasserian Ganglion. British Medical Journal, 1899, vol. ii, p. 1080.

[19] P. L. Friedrich, Krankengeschichten und Heilungsausgange nach Resection u. Extirpation des Ganglion Gasseri, etc. Deutsche Zeitschrift für Chir., Bd. 52.

[20] Georg Köster, Klinischer und Experimenteller Beitrag zur Lehre von der Lähmung des Nervus facialis, zugleich ein Beitrag zur Physiologie des Geschmackes, der Schweiss-Speichel- und Thränenabsonderung. Deutsches Archiv für klin. Med., 1900, Bd. 68, p. 342.

[21] Sherrington, Examination of the Peripheral Distribution of the Fibres of the Posterior Roots of some Spinal Nerves. Philosoph. Transactions of the Royal Society, London, 1898. Series B, vol. 190. p. 56.

[22] Gowers, Taste and the Fifth Nerve, The Journal of Physiology, vol. xxviii, July, 1902, p. 300.

[23] A Manual of Medicine, Allchin, vol. iii (Diseases of the Nervous System), 1901, p. 234.

cation between the branches of the two sides and that impulses may reach the brain from the paralyzed side by way of median communications of this sort which subsequently may undergo atrophy.[24] Hence, he believes, that there is a possibility of early transmission of taste perception with its subsequent disappearance. The series of cases the results of which I shall report seem to indicate quite a contrary state of things, namely an early disappearance or partial disappearance of taste perception in a large proportion of cases with a subsequent return in large part of the same. It seems improbable also, should these impulses pass through such median communications, that localization of taste would be as perfect as it has been found to be and also improbable that such communications would pass to the outer border of the tongue where taste usually remains acute. Inasmuch as not all of my cases have been examined for late disappearance (months or years after the operation) of taste, the possibility of such a sequel must be granted, but should the sense be found absent I would be inclined to account for its loss by an implication of the fibres of the chorda tympani in late degenerative processes which have taken place in the N. lingualis.

In my own series of thirteen cases the precaution has been taken, whenever the patient's condition allowed of such observations, to make thorough tests for taste perception before the operation in order to establish in a certain degree the patient's personal equation. In this way it has been possible in a measure to train the patient in the recognition of taste sensations, especially those originating from the anterior part of the tongue. Such recognition for many individuals is a difficult matter and only by preliminary training has it been possible to overcome this obstacle to the examinations and also to eliminate in a certain degree the confusion which arises after the operation, owing to the presence of anæsthesia to other forms of sensation in the part of the tongue with which we are chiefly concerned. One of my earlier patients, for example, found it impossible to identify with certainty any of the primary taste qualities anterior to the circumvallate papillæ on either side of the tongue either before or after the operation. In a later case a similar uncertainty was gradually overcome by training, and after several trials the patient learned to identify promptly the four taste qualities. In this particular case after the operation the patient insisted that he tasted "plainer" on the anæsthetic side than on the other after removal of the ganglion. It is to be remembered that Vintschgau long since called attention to the great individual variation in "Geschmacksfähigkeit."

As a rule, in all of my later cases, tests have been made for the four primary forms of taste sensation—sweet, sour, bitter and saline—not only on the anterior and posterior portions of the tongue but also on the palate. Subsequent to the operation, as frequent tests have been made as circumstances allowed, during the patient's hospital residence, and these serial observations have brought out the fact mentioned above that in many cases at least there is a temporary diminution in acuity, or even a complete disappearance of the sense of taste over the anterior two-thirds of the tongue which endures for a variable number of days after the operation. In my first case alone did I fail to establish this final return of taste perception. One isolated observation was made on this patient six days after the operation, at which time it was noted that there was a complete absence of taste anteriorly on the operated side. As will be emphasized later, the same observation would have been made on the majority of the succeeding cases had reliance been placed on the truth of a single test made at a corresponding time after the extirpation.

It may not be out of place in this connection to state, lest there be some query as to the completeness of the operation, that the extirpation in all of these cases, with the exception of two, has been a total one, and that the ganglion with the intracranial stumps of all three divisions and the sensory root has been removed in its entirety and in a state of preservation in most cases sufficient for photographic reproduction. The two cases referred to, owing to operative difficulties were of necessity incomplete extirpations, the lower two-thirds of the ganglion only being with certainty excised. In both cases, however, the second and third divisions were removed with the neighboring portion of ganglion and the completeness of the intrabuccal areas of anæsthesia in these cases make them to all purposes as valuable for observations upon taste as if the entire ganglion, as in the other eleven cases, had been taken away.[25]

The area of post-operative intrabuccal anæsthesia is shown in the accompanying sketch (Fig. 2) and represents with but slight modification the areas mapped out in all of my cases. The territories correspond very well with those found by Sherrington to be present after experimental division of the trigeminal nerve in monkeys. Although the large part of this territory of anæsthesia should remain absolutely and permanently unchanged, careful examination of the tongue will show that in a certain percentage of cases the anæsthesia does not persist in its absoluteness. In several of my cases I have found after some days and in association with the return of taste, that certain forms of stimuli, such as the

[24] It is noteworthy that Zander has shown by methods of dissection that there is anatomically a slight macroscopical overlapping of the lingual nerve for some mm. across the median line. Ueber das Verbreitungsbiet der Gefühls und Geschmacksnerven in der Zungenschleimhaut. Anatomischer Anzieger. Bd. xiv, s. 131. Such an overlapping, as far as physiological activities are concerned, is hardly, if at all, demonstrable by methods of examination with the æsthesiometer after trigeminal neurectomy.

[25] The operation in all instances has been performed by the procedure described in the Journal of the American Medical Assoc., 1900, vol. xxxiv, p. 1035. Inasmuch as the method necessitates the preservation of the middle meningeal artery, the manipulations of freeing the ganglion are confined to a situation far enough anterior to render the likelihood of injuring the geniculate ganglion and the petrosal nerve a very remote one. The possibility of the occurrence of such an injury during the Hartley-Krause method of operating has been suggested by those favoring the N. intermedius (Wrisburg) path of taste conduction in their attempt to explain the loss of taste after ganglion extirpation.

movement of a cotton swab over the surface of the tongue, will give a peculiar tactile sensation which is localizable, anæsthesia to pain, temperature and to touch by the hair æthesiometer meanwhile remaining complete.

It seems not impossible that the chorda, representing as it may the sensory portion of the N. facialis, may contain afferent fibres transmitting qualities other than those of special sense. Köster (loc cit., 1900, p. 571) as a result of his experimental work was led to this same conclusion and in his second paper (loc cit., 1902, p. 519) reports cases of facial paralysis in which a hemilingual hypæsthesia has accompanied the loss of taste on the anterior area of the tongue.

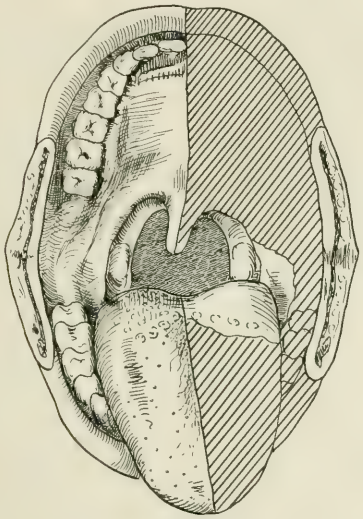


Fig. 2.—Sketch showing the postural deformity with open mouth and during phonation after extirpation of the G. semilunare on the left side. The areas of complete anæsthesia to common forms of sensation indicated by shaded lines.

In making the tests the following precautions have been observed: After thorough rinsing of the mouth with warm water the tongue is protruded and its surface gently dried with a towel. The following system of prearranged signals enables the patient without withdrawing the tongue to indicate, first by a slight nod of the head when he recognizes the presence of anything upon the anæsthetic portion of the tongue, second by raising the hand when the quality of the substance is recognized, and third by pointing to one side or the other to indicate the localization of the taste on the right or left side of the tongue. The substances used have always been in a more or less concentrated solution and most of the tests have been made with the following: simple syrup, quinine or strychnine solutions, acidum hydrochloricum dil. or lemon, a solution of common salt and one pole or the other of a weak faradic or galvanic current. The solutions have been used at the room temperature and have been applied usually with a small cotton swab. The delineation of the moistened area can be observed accurately in case the surface has been previously dried. In some cases the precaution has been taken of staining the fluid with methylene blue as Kiesow [26] has done in his observations.

After each trial the mouth has been cleaned and a sufficient length of time allowed to elapse before making a second test and on any evidence of uncertainty in the interpretation further observations have for the time being been postponed. Examination of the soft palate is comparatively easy, especially upon the operated side, inasmuch as the gagging reflex is abolished by the operation.

It is unnecessary to give the notes of all these cases in full, as there has been such conformity in the findings that a few illustrations will suffice.

Case I.—The patient, an intelligent German, afflicted for years with the most severe type of right sided trifacial neuralgia, which had recurred promptly after several peripheral operations, entered the hospital suffering too acutely to allow of any preliminary examination of taste sensation. The ganglion (Rt.) was removed with sensory root and three branches in toto, February 15, 1901, the day after admission.

February 26 (11 days).—First observation on taste. Anterior two-thirds of tongue, soft palate, anterior pillar of fauces, completely anæsthetic to common forms of sensibility.

Anterior two-thirds of tongue,—

	Right.	*Left.*
Syrup.	Not recognized in 60 sec.	Recognized immediately.
Salt.	Not recognized in 60 sec.	Recog. immediately.
Quinine.	Not recognized in 60 sec.	Recog. immediately.
HCl. dil.	Not recognized in 60 sec.	Recog. immediately.

The last substance although not recognized on the right gave a sensation of puckering described as "Zusammenziehung." All of these substances were recognized immediately on the posterior part of the tongue.

March 4 (17 days).—Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup.	Recognized in 30 sec.	Recog. immediately.
Salt.	Unrecognized but gave sensation of "Gänzehaut" in 30 seconds.	Recog. immediately.
Quinine.	Questionable.	Recog. immediately.
HCl. dil.	Recog. in 20 seconds.	Recog. immediately.
Elec. taste.	Coppery taste recog. immediately and localized but no "sting". Palate ditto.	Coppery taste recognized. immediately and accomp. by elec. "sting". Palate ditto.

March 18 (31 days).—Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup.	Recog. in 15 seconds.	Recog. immediately.
Salt.	Recog. slowly.	Recog. immediately.

Palate.

Syrup recog. immediately on both sides. Anæsthesia remains complete on right.

[26] Kiesow, Zeitschrift für Psychologie und Physiologie der Sinnesorgane, 1902, vol. xxv, p. 415.

March 25 (37 days).—No appreciable difference in reaction time on two sides to sugar, salt, quinine and lemon solutions.

December 11 (10 months).—Areas of post-operative anæsthesia remain practically unchanged. No appreciable overlapping in median line either of face, palate or tongue. No shrinkage of intrabuccal area detected. Slight shrinkage (1-2 cm.) of posterior edge of facial cutaneous area which is anæsthetic to common sensibility.

Taste. Anterior two-thirds of tongue.

	Right.	*Left.*
Syrup. Obs. I.	Recog. in 30 sec.	Recog. in 20 sec.
Obs. II.	Recog. in 30 sec.	Recog. in 20 sec.
Obs. III.	Recog. in 15 sec.	Recog. in 15 sec.
(About 30 min. interval between observations.)		
Salt.	Recog. immediately.	Recog. immediately.
Lemon.	Recog. in 5 sec.	Recog. in few sec.
HCl. dil.	Recog. "sour" immediately.	Recog. sour plus "sharp" sensation immediately.
Quinine.	Recog. 20 sec.	Recog. 20 sec.
Electric.	"Metallic" taste immediately.	Ditto plus electric "prickle".

Palate.

	Right.	*Left.*
Lemon.	Recognized in five seconds on both sides.	
Quinine.	Recog. immediately, "plainer than on tongue" both sides.	
Salt and Sugar Solutions.	Uncertain on both sides.	Tasted but referred to base of tongue.
Electric taste.	Recog. immediately and metallic taste said to be "plainer than on tongue". No "prickle" felt on right side of palate.	

It is to be noted that taste localization remains perfect over the anæsthetic areas. The solutions were usually applied on the outer edge of the protruded tongue. All substances were recognized immediately over the base of the tongue and a slight touch of the swab holding the quinine solution could be localized on the epiglottis. It is noteworthy that sweet substances on the anæsthetic side of the tongue seemed to call forth reflexly a much more abundant flow of saliva than when placed on the normal side. The patient was confident that the subjective acuteness of taste was equal on the two sides.

The case demonstrates clearly that there was a post-operative transient period of abolition of taste perception with a gradual return to the normal or practically normal state. More delicate tests with solutions of less concentration possibly would be required to assure the absoluteness of the restoration.

The following case shows that this temporary loss may not be complete but merely a lessening of acuity, shown by a prolongation of the reaction time of perception, and furthermore that it is not an immediate consequence of the extirpation.

Case II.—The patient entered the hospital July 8, 1902, during an interval of comparative freedom from pain so that it was possible to make some preliminary observations on taste. These demonstrated that the recognition to all four primary forms of taste was fairly prompt and apparently equal on the anterior and posterior parts of the tongue. The reaction time to bitter substances was somewhat slow anteriorly.

July 12, 1902.—Extirpation of the ganglion (left side).

July 15 (3 days).—Anterior portion of tongue: immediate recognition of sweet and saline substances on anæsthetic as well as normal side of tongue.

July 22 (10 days).—Anterior two-thirds of tongue:

	Left.	*Right.*
Salt.	"Tasted" after 70 sec. and then unrecognized.	Recog. almost immediately.
Syrup.	Tasted after 20 sec.	Recog. immediately.
Quinine.	Not recog.	Recog. in 20 seconds.
HCl. dil.	Recog. in 20 seconds.	Recog. immediately.

July 28 (16 days).—

	Left.	*Right.*
Salt.	Recog. in 3 seconds.	Recog. immediately.
Syrup.	Recog. in 10 seconds.	Recog. immediately.
Quinine.	Recog. in 60 seconds.	Recog. in 20 seconds.

July 31 (19 days).—

Syrup.—"Tasted" almost immediately on left side and localized, but difficulty experienced in recognizing substance for some seconds. A drop of lemon juice recognized immediately on both sides.

August 3 (22 days).—

	Left.	*Right.*
Salt.	Recog. immediately.	Recog. immediately.
Sugar.	Recog. immediately.	Recog. immediately.
Quinine.	Recog. in 30 sec.	Recog. in 30 sec.
HCl. dil.	Recog. immediately.	Recog. immediately.

On the anæsthetic side of the palate very much the same occurrence was appreciable for the two substances normally recognizable there, namely the saline and bitter solutions. On the tenth day salt and quinine were only recognized on the sound side. On the 16th day the bitter solution was immediately recognized on both sides and the saline was localized and identified on the anæsthetic area although less perfectly than on the normal side.

December 10 (5 months).—The facial and intrabuccal areas of post-operative anæsthesia remain practically unchanged except for a slight shrinkage of the posterior border of the former. The left half of the tongue anteriorly is anæsthetic exactly to the mid-line to tactile (hair æsthesiometer) pain (needle) and thermic stimuli. Rubbing with a cotton swab, however, gives the peculiar tactile sensation often noticed in these cases. It is perfectly localizable.

Taste. Anterior two-thirds of tongue.

	Left.	*Right.*
Salt.	Recognized in 15 secs.	Recog. in 10 secs.
Syrup.	Recog. ("sweet") in 15 sec.	Recog. in 20 sec.
HCl. (*dil*).	Recog, "sour" in 10 sec.	Recog. in 5 sec. "Sour and burned."

Quinine—Recog. alike on both sides of tongue, first as "sweet", and not as "bitter" until after 30 seconds.

Electrical taste—Recog. immediately on both sides but with no "sting" on the left.

It is to be noted that the effort was made in all of these examinations to delude the patient as to the substance chosen for the test and the last (December) observation on this patient shows in how much the element of practice is helpful in reducing the reaction time in recognizing the four or five simple substances employed. In a later examination on this same date most of the substances were recognized, as at the time of the August examination, immediately.

Other illustrations need hardly be given. The element of training must, of course, be taken into consideration and I find that almost invariably patients succeed in identifying taste qualities with much greater promptitude after the experience of a few trials. On the first observation before the operation, the reaction time of recognition for most substances put on the protruded tongue is much longer than on subsequent observations. Considerable variations in facility of recognizing substances are often appreciable on different occasions from fatigue or abstraction even under normal conditions.[27] There are certain things worthy of special attention. In several of the cases there has been no perceptible loss of taste qualities, in so far as our rough methods could detect them at any time, on tongue or palate after operation. It is important also to note that irritating stimuli like the dilute hydrochloric acid and faradic current may still be tasted, localized and recognized as acid or "coppery," but the unpleasant sensation or "sting," owing to the abolition of common sensibility, is no longer perceived. An analogous effect of the operation is to be observed in the case of smell since irritant fumes like those of ammonia can be recognized but no longer irritate the Schneiderian membrane when inhaled on the operated side. The fact also that taste qualities are localizable, in spite of existing anæsthesia to common forms of sensibility, is interesting from a psychological point of view and may be taken as an evidence that the sensory transmission does not occur by a possible commissural path of anastomatic fibres across the median line.

I find it difficult to reconcile my fairly uniform results, that is, uniform in so far as the ultimate preservation of taste is concerned, with the contradictory observations which have been made by so many others. The only explanation which I can offer is that there may be in a considerable percentage of the cases a temporary diminution in its acuity or a complete abolition of taste as has been indicated above, and that this may have been interpreted under certain circumstances as an evidence of permanent loss of this sense. Inasmuch as the temporary period of loss occurs during the first two or three weeks after the neurectomy, a period which roughly may correspond with the average residence of the patient in the hospital and under immediate observation, the return of taste may in some instances have been overlooked.

It seems possible that this early and transient disappearance of taste which several of my cases have shown may be attributable in one way or another to the post-operative degeneration and swelling, which owing to the removal of the ganglion must affect the fibres of the N. lingualis. In this way the neurectomy may indirectly affect the transmission of gustatory impulses from the anterior portion of the tongue without the necessary inference that the chorda fibres actually pass by the trigeminal route to the brain. Thus the mere mechanical pressure of the swollen lingual fibres might accomplish this or else, as Dr. Rusk has suggested to me, there may be a certain toxic effect of the products of degeneration of lingual fibres which temporarily may give a physiological "block" to chorda activities. Intimately intermingled as the fibres of the two nerves are for a part of their course, this might readily take place, and that the chorda fibres remain intact is shown by the early return of taste perception. The time of active degeneration corresponds fairly well with the period of diminution or loss of taste and it has been noticed in a few instances for a day or two after the operation, as in Case I cited above, and before such degeneration may have become complete, that taste was preserved although it subsequently disappeared for a time.

Such a mechanical interference with the normal transmission of impulses may very well explain the extraordinary observations made by Schiff[28] and by Ferrier which were interpreted as an evidence that some taste fibres passed directly along the lingual. They found that section of this nerve above its union with the chorda tympani produced in some cases a partial loss of taste. It is conceivable also that the late fibrous change in the elements of the lingual nerve following upon its atrophy and destruction may in certain cases ultimately interfere with the function of the intermingled fibres destined to form the chorda tympani. This, however, is only a conjecture.

The object of this communication is to negate the possibility of taste transmission by way of the N. trigeminus rather than to advocate any other course for these fibres. It may be said, nevertheless, in passing, that the generally accepted statement to the effect that an intracranial lesion of the N. facialis is unaccompanied by loss of taste, seems to be made on rather slight evidence and should be given the further confirmation, if possible, of experimental observations. The portio intermedia is of considerable size and sufficiently distinct from the portio mollis to escape injury, even though an intracranial lesion may clinically have produced complete facial paralysis. Embryological studies furthermore have

[27] There seems to be little doubt that, as v. Vintschgau originally emphasized, there are special neurones subserving the function of carrying the separate taste qualities just as v. Frey has shown to be the case with the various forms of common sensibility. This has been apparent in many of our observations from the return of certain forms of taste sensation before others after the complete temporary abolition of all of them. Köster in his second paper has called attention to the physiological fact of variable resistance which these different sets of fibres possess, believing for instance that the fibres conveying sensations of "sweet" are more sensitive to injury than those of "sour."

[28] Schiff, Les nerfs gustatifs. Rev. Méd. de la Suisse romande Genève, 1887, t. vii, p. 54. Schiff believed that these fibres passed along the lingual and left it by a small [anatomically inconstant, (Hyrtl.)] branch to the otic ganglion.

established beyond question that the facial nerve is a mixed nerve, whose afferent sensory portion is represented by the N. intermedius and His has shown that the Chorda tympani and the great superficial petrosal in the lower vertebrates, as well as in man, are portions of the VIIth nerve. If, therefore, they are developmentally outgrowths of the geniculate ganglion, on the principles established by His concerning the development of nerves, they must be afferent nerves and would not transmit impulses in a direction toward the Gasserian ganglion, as those believing in the Vth route theory claim that they do.

Judging from the uniform results of observations on this series of cases it may be said in conclusion.

1. That the perception of taste is unaffected on the posterior portion of the tongue and never permanently or completely lost on its anterior two-thirds after removal of the Gasserian ganglion.

2. That a temporary abolition or lessening of the acuity of taste may be found to exist over the anterior and anæsthetic portion of the tongue for some days after the operation.

3. That this temporary loss of function may possibly be occasioned by some interference with chorda transmission brought about by a mechanical or toxic disturbance due to degeneration of the N. lingualis.

4. That a lesion of the trigeminal nerve may be associated with disturbance of taste over the chorda territory without the necessary inference that the nerve is a path for gustatory impulses.

5. That the N. trigeminus in all probability does not convey taste fibres to the brain either from the anterior or posterior portion of the tongue.

ON THE USE OF CLAY MODELING IN THE STUDY OF OSTEOLOGY.

By Robert Orton Moody, M. D.,

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(*From the Hearst Anatomical Laboratory of the University of California.*)

Before the introduction of the laboratory idea into medicine, osteology was studied either by means of books or by the use of books and bones. In many places it has been and still is difficult to get skeletons, leaving medical schools to find recourse to the use of stock collections, which are loaned to students on the principle of the circulating library. With the reform that came in teaching methods, the chief modification in the system has been in the redistribution of the student's time, the greater portion of which is now spent in direct study of the skeleton. In fact, this follows a marked tendency noted in many branches to adopt more and more, simple objective methods and to depend less and less on descriptive work. This principle, which may be stated as the exchange of visual for verbal images, is now suggestively emphasized by the growing demand for good anatomical atlases. Word descriptions alone no longer suffice as a vehicle for ideas of form or relations of structures that occupy three dimensions of space. Of all the improved methods in the study of osteology, the introduction of drawing gave us the easiest device by which we could be assured that the student spent a certain amount of time with the specimen. To this method the use of clay modeling has recently been added in the routine work of classes in osteology. In one way or another, however, the use of models, in anatomy, is quite old, and it is only necessary to refer to the beautiful series of Steger and Ziegler to show the great advances that have been made along this line. Dr. Clarence Webster of Chicago has for some time employed clay models as a method of recording operative procedures in gynecology. In the anatomical laboratory of the Johns Hopkins University it was first used in routine courses in osteology. Later the method was adopted and expanded in the University of Chicago. A short account of the method as it is employed in the anatomical laboratory at Chicago, together with its results, has been recently published.[1]

In the course in osteology in this University, the method has been extensively tested. Here, students are required in the laboratory work to model as well as draw all the bones of the body. No attempt is made to have the student memorize muscle attachments or learn relations of the ligaments. They are taken up later during the period of dissection, when these structures are directly before the student. The course is entirely objective and nothing concerning the bones is learned that cannot be seen. A few general lectures are given to outline the development of the skeleton and to discuss certain facts of comparative osteology. Occasional recitations are held to control chiefly the student's reading and to develop a power of systematic, objective description distinct from that obtained in the general text-books.

[1] It is interesting to note also that Cone (Bulletin of the Johns Hopkins Hospital, Vol. XIII, June, 1902) demonstrated before the Medical Society of the Johns Hopkins Hospital a method of clay modeling in the study of osteology.

University Record. Vol. 7, No. 3, 1902.

The outfit of the student consists of a paraffined board and two modeling tools, Boxwood 64 and E. & B. No. 3. The first of the instruments may be easily made by any one who can use a jack-knife, and the second by any one who has in addition a little manual dexterity. The board should be a piece of kiln-dried finished wood about 60 centimeters long, 50 centimeters wide, and 2 centimeters thick. It is well to have it coated with boiling paraffin to prevent the clay from sticking or the board from warping. We have found it desirable to use the best potter's clay that can be obtained. This should be free from stains and foreign bodies. It is prepared by grinding it to a fine powder and, after passing it through a sieve, adding a sufficient quantity of water. This mode of preparation not only removes foreign bodies but permits the water to act evenly on the clay. It is important to have the two homogeneously mixed. Clay that is more moist in some parts than others is difficult to mold and liable to crack when dry, thus destroying the model. It is ready for use when it contains enough water to mold easily but not sufficient to make it sticky. When there is a little too much moisture, kneading will often bring it to a proper consistency, but if it is very wet and sticky some powdered clay may be added to take up the excess. In this case, however, the kneading should be thorough in order that the clay shall have throughout a uniform moisture. When given to the students, the clay should be in the proper state of plasticity for immediate use, but it is well, however, to have the student thoroughly work it over with his hands, for the better the clay is worked, the more readily it can be molded. The bones should be completed while the clay is still in a plastic condition. This state can be maintained indefinitely by covering the model with wet cloths during the various stages of its preparation. There is a notable tendency among the students, especially before they have learned how to handle soft clay, to outline the bone roughly, let the clay harden, and then carve and finish the model. This, however, is unsatisfactory, as the student who carves loses the training of the tactile sense and often cannot make the necessary changes which the instructor suggests to improve the model or make it conform more closely to the original specimen. In fact, the less modeling the student does with his tools and the more he does with his fingers, the greater will be the benefit of the work to him. The use of the fingers, perhaps, develops to a slight degree the muscle sense, but through the sense of touch one gets a conception of the form and relations of the bone that can be obtained in no other way. Most of the bones are modeled as isolated objects, but some of them, preferably the more fragile ones, like the fibula, may be modeled on a base. The skull, the wrist and hand, and the ankle and foot are usually modeled on a base. To model some of the long bones which have naturally only one or two points of contact with the underlying board it is often necessary to support the shaft at short intervals by clay pillars which remain under it until the model is dry. When the student has completed a specimen the original bone as well as the model is submitted to an instructor. This, too, should be done while the model is still in a plastic state, for a careful comparison of the model with the bone usually reveals the necessity of changes, sometimes quite fundamental. Not infrequently the student carries the modeling of one or two dimensions nearly to completion without due regard to the others. In order to produce good results it is naturally necessary to bear in mind constantly the relations of one to the other two dimensions. When the bone is finished and accepted by an instructor it is marked with the name or initials of the maker and placed with the remainder of his specimens. The general form and appearance of a model made on a base may often be brought into sharp relief by coating the base with shellac and then with enamel paint or by coating both base and model with shellac and paint of different colors for a contrast. If it desired to make the models permanent they may be burned like pottery. At the end of the time scheduled for osteology a practical examination is given in which each student is required to model one bone and draw several others entirely from memory.

The value of the method is obvious, for in drawing the student is forced to depend on the more or less arbitrary laws of perspective, while in modeling he is not only enabled to represent the object in three dimensions just as it exists in nature, but registers repeated visual impressions and probably uses his muscle sense as well as the sense of touch. Owing to the importance of a certain knowledge of drawing to the student of medicine, he is required as a matter of routine to draw the bones of the body, chiefly as a general training. The value of drawing, however, is not to be underestimated as an aid to modeling in the study of osteology. During his course the student should be required to use text-books and read the descriptions of the bones as he models. The tendency in general is for a dissociation of these two important portions of the work, as the average student prefers to make his model and subsequently read and identify its parts. He should associate the names of objects with their images and the only way that this can be enforced is to insist on laboratory reading.

It requires, in time, about six half days a week for seven weeks. The average and poorer students may require some extra time outside of the laboratory periods. Two afternoons a week for three weeks are devoted to drawing in order to criticize the student's technique. The remainder of the drawing, however, is done outside of the regular class hours. Following is a schedule which, in our experience, has been best adapted to work of this nature:

OUTLINE.

24 hours per week.

1st week:
Clavicle.
Scapula.
Sternum.

2d week:
Humerus.
Radius.
Ulna.
Ribs—1 typical and 1 of each atypical.

3d week:
Wrist and hand.
Vertebræ—1 typical of each region and 1 of each atypical and sacrum.

4th week:
Os innominatum.
Femur.
Tibia.

5th week:
Ankle and foot.
Fibula.

6th and 7th weeks:
Skull.

It has seemed wise, in view of the various pedagogical changes which have been recently introduced in anatomy, to have some definite experimental evidence of the value of the method, to test, if possible, the relative worth of visual and verbal images in conveying ideas of form. Accordingly after the regular work of the class was finished an unknown bone was accurately described and photographed. The class was divided into three groups; the first received the photographs alone, the second the photographs and description, while the third was simply given the verbal picture. With these aids the students were required to model the bone in clay. The specimen is represented in Figures 4a, 4b, while following is the detailed description of the bone from which they worked.

This left scapula is a thin, flat bone, approximating in shape a paddle or an isosceles triangle with curved outlines having the medial border for its base and the glenoid cavity for its apex. It has two surfaces, dorsal and ventral, three borders, medial, cephalic, and caudal, and three angles, lateral, meso-caudal, and meso-cephalic.

If the bone rests on its curved caudal border the straight base line of that border, extending from the meso-caudal angle to the caudal border of the glenoid cavity, is $5\frac{1}{2}$ inches long. The caudo-cephalic diameter of the bone at the lateral extremity of the base line is $1\frac{1}{2}$ inches, at its medial extremity $3\frac{1}{4}$ inches. The caudal border is a little more than $\frac{3}{8}$ of an inch thick throughout its entire length. From the edge of the glenoid cavity which forms most of the lateral angle this border slopes sharply cephalad so that $\frac{3}{4}$ of an inch from the edge it has sloped $\frac{1}{2}$ an inch. From this point for $2\frac{3}{4}$ inches it is straight and then slopes gradually to the meso-caudal angle.

For a distance of $1\frac{5}{8}$ inches from the meso-caudal angle the caudal border presents two surfaces, one approximately triangular placed ventrally, looking caudad is $\frac{3}{8}$ of an inch wide at the medial border and $\frac{1}{8}$ of an inch wide at its apex. The other surface $\frac{1}{4}$ of an inch wide looks dorsad: $\frac{5}{8}$ of an inch from the medial border it begins to slope ventro-caudad and winding around the apex of the triangular surface merges with the adjacent rounded part of the border. The rounded part of the border extends laterad $1\frac{1}{4}$ inches rounding toward a ridge which separates this border from the dorsal surface and also rounding toward and becoming continuous with the ventral surface. Laterad of this round portion the caudal border for $2\frac{1}{4}$ inches presents two surfaces, one surface begins as a ridge looking dorsad and gradually widens so that it becomes $\frac{3}{16}$ of an inch wide and looks directly caudad. The other surface continuous with the rounded portion of the border is $\frac{5}{16}$ of an inch wide and its medial extremity looks caudad but turns so that its lateral half is on a plane midway between the plane of the caudal surface and the plane of the ventral surface. The lateral $\frac{3}{4}$ of an inch of this border presents a triangular tuberosity and the convex caudal border of the glenoid cavity. The triangular tuberosity $\frac{3}{8}$ of an inch long has its apex directed mesad.

If from a point on the diameter that passes through the meso-caudal angle $2\frac{7}{8}$ inches cephalad of the angle a perpendicular be dropped mesad $\frac{5}{8}$ of an inch in length, its termination will be at the point of greatest convexity of the medial border. The medial border is convex, $\frac{1}{8}$ of an inch thick throughout most of its extent and $\frac{1}{4}$ of an inch thick at the caudal end.

If at a point on the caudal base line $2\frac{1}{8}$ inches laterad from the meso-caudal angle a perpendicular $3\frac{7}{8}$ inches long be drawn cephalad its terminal point will be the point of greatest convexity of the cephalic border. A similar perpendicular whose terminal point would be in the cephalic border, erected 2 inches mesad from the latero-caudal angle would be 3 inches long.

At the neck the bone is $1\frac{1}{2}$ inches in diameter. The cephalic border is thin, convex and extends $\frac{7}{8}$ of an inch laterad beyond the caudal border. It terminates in the tuberosity which projects beyond the glenoid cavity $\frac{1}{2}$ an inch. This tuberosity has a rounding surface looking in its medial part cephalad, dorsad and mesad, and it its lateral part cephalad, dorsad and laterad. The caudal surface of the part of the tuberosity that projects beyond the glenoid cavity is smooth and continuous with the articular surface of the cavity.

The meso-cephalic angle is thin and rounded, the meso-caudal angle is thick and nearly a right angle, but slightly obtuse.

The dorsal surface is divided by a spine into a supra-spinous fossa and an infra-spinous fossa. The spine runs from the middle border of the glenoid cavity through a



FIG. 1.—A number of average specimens of the work of the class picked haphazard from the entire series.



FIG. 2.—Four skulls modeled during the laboratory hours. One shows the method of modeling and coloring the base.



FIG. 3.—Bones modeled from memory during the examination by some of the better students of the class.

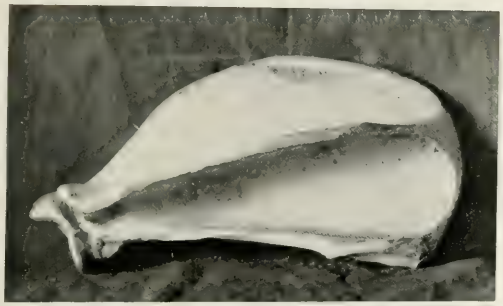


FIG. 4a.—Dorsal view. Scapula which was used in class experiment.

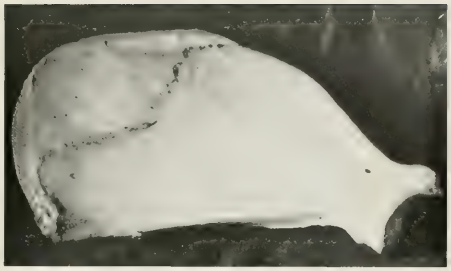


FIG. 4b.—Ventral view. Scapula which was used in class experiment.

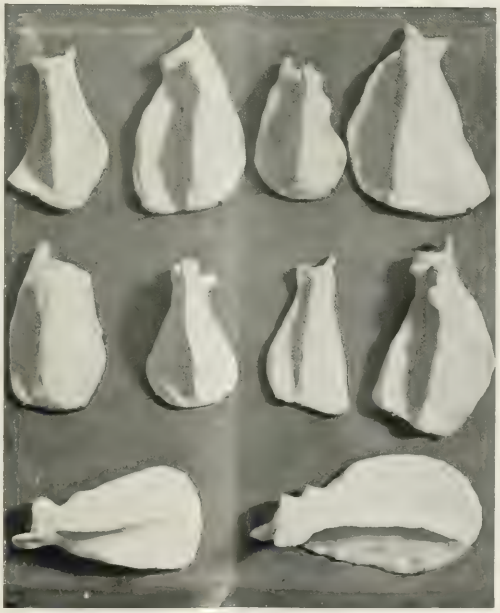


FIG. 5.—Clay models made from a verbal description of the scapula shown in Fig. 4.

point $1\frac{5}{8}$ inches cephalad of the caudal base line, in a perpendicular erected $1\frac{1}{2}$ inches mesad of the lateral extremity of the base line, to the medial border. The infra-spinous fossa for $\frac{1}{2}$ inch at its lateral extremity is flat, for the next inch it slopes mesad, and becomes concave from the spine to the caudal border. Throughout the rest of its length it is flat from the base of the spine nearly to the caudal border, then curves sharply dorsad to that border. Mesad the infra-spinous fossa terminates in a very shallow overhanging lip formed by the medial border. The supra-spinous fossa in its middle $\frac{3}{4}$ is slightly concave from the spine to the cephalic border and flat throughout the rest of its extent rounding toward the cephalic border just before reaching it. The *ventral surface* is slightly concave from the medial to the lateral extremity. It is subdivided by two slight ridges marking the insertion of muscles into three triangular areas. The cephalic line starts at a point $\frac{3}{4}$ of an inch from the cephalic border and $1\frac{1}{4}$ inches from the margin of the glenoid cavity, runs to the meso-cephalic angle. The caudal line starts at a point $\frac{5}{8}$ of an inch from the caudal border and 2 inches from the margin of the glenoid cavity, terminates at a point $1\frac{1}{2}$ inches cephalad of the meso-caudal angle. The middle area between these two ridges is slightly concave. An irregular rough curved ridge runs from the middle of the cephalic border and at right angles to it to the point of intersection with the cephalic line where it turns and runs to a point of intersection with the caudal line $\frac{1}{2}$ inch from the medial border. It then turns sharply and runs to the meso-caudal angle. The *spine* which is $\frac{1}{8}$ of an inch thick and begins as a flattened triangular eminence at the medial border of the dorsal surface slopes dorsally toward the lateral extremity so that it is 1 inch high at the middle of the bone and the same height at its termination $\frac{3}{8}$ of an inch from the margin of the glenoid cavity. It has two surfaces, cephalic and caudal, and two borders, dorsal and lateral. The cephalic surface is flat. The caudal surface is very slightly concave owing to the overhanging dorsal border. The dorsal border is flat and $\frac{3}{16}$ of an inch wide from the apex of the smooth triangular eminence to within 2 inches of its lateral extremity where it changes its direction so as to look dorsad and cephalad. $1\frac{1}{2}$ inches from the lateral extremity it expands caudally to form the acromion process which is $\frac{1}{2}$ an inch wide and looks dorsad and slightly cephalad. The lateral border is $\frac{3}{16}$ of an inch thick and rounded.

The oval glenoid cavity which forms the lateral angle of the bone has a caudo-cephalic diameter of 1 inch and a dorso-ventral diameter of $\frac{3}{4}$ of an inch. It is concave in the direction of both diameters, being more concave in its caudo-cephalic diameter. At its cephalic end it terminates in the smooth triangular surface of the projecting tuberosity of the cephalic border. This surface looks almost caudad but slopes cephalad forming a slightly obtuse angle with the glenoid cavity and is $\frac{1}{2}$ an inch in length from base to apex.

A few of the typical results are shown in Figure 5. Those students who were provided simply with the photograph finished modeling in a little over an hour, those who had both photograph and description took between two and three hours, while those who worked from the description alone occupied from three to four hours in the making of a model. The results, moreover, were not strictly comparable, for the class was divided into groups unequal in size and ability. Group three contained the best students and over two-thirds of the class. The finished models seem when liberally interpreted to emphasize especially the inadequacy of verbal images to represent structures occupying three dimensions of space. Certain students as will be seen from an inspection of the models produced a right, while others modeled a left scapula, although this point was distinctly mentioned. They show, moreover, very different conceptions of size, form and relations, and if the results are compared with Figure 3, which represents bones modeled from memory during the regular examination of the class, it seems as though the visual image is much superior to the verbal as a vehicle of the concept of form. This experiment may have an important bearing on the question of lectures covering structures occupying three dimensions. Unless provided with the object it would be difficult for an average class to follow the intricacies of the description, and the sum total of good accruing from the method would simply be a certain degree of familiarity with the terminology. It is possible that students of gross anatomy might be helped by lectures after they had dissected the body once or twice, although there is some question whether the time could not be more profitably spent in the quest of actual objective information, for, as Jordan says, the only knowledge that is really worth having is knowledge which the student can test for himself.

In conclusion, it is a pleasure to express my thanks to Professor J. M. Flint for his kind assistance in the preparation of this article.

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Reed, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo, with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the JOHNS HOPKINS PRESS, BALTIMORE, MARYLAND.

THE TREATMENT OF AURAL EXOSTOSES.

By H. O. Reik, M. D., *Clinical Assistant in Ophthalmology and Otology.*

My object in speaking of the treatment of aural exostoses is to suggest the revision of a statement common to practically all of the text-books on otology which I believe constitutes, for the present day, a matter of false teaching. Every such book that I have been able to consult for advice on this subject lays down the rule that an exostosis of the external auditory canal is not to be operated upon unless it is so completely blocking the canal that it prevents the exit of pus from a coexisting suppurative otitis media and thus endangers the life of the patient, or, unless because of its size it obstructs the entrance of sound waves and produces a profound deafness in a person who is also deaf on the other side from this or any other cause. I have found but one exception, the American Text-book of Diseases of the Eye, Ear, Nose and Throat, and that book gives conflicting advice in that the the author of the chapter on Diseases of the Auricle recommends the wider application of operative measures, while the author of the chapter upon Operations upon the Ear reiterates the advice referred to above. Since medical treatment looking to the absorption of these bony growths has been of no avail and as they threaten the individual with either loss of hearing or more serious trouble, I have been at some pains searching the literature to discover a reason for this general counsel of non-intervention.

The law probably originated with Toynbee, for the first reference containing it which I have found was published by him in 1849, but, strange to say, the same sentiment has been repeated in every work on otology published since that date in spite of the numerous articles that have meanwhile appeared giving the histories of cases successfully operated upon and notwithstanding the improvement in surgical methods since that period or the oft-repeated pleadings of otologists of standing, especially Fields, Delstanche, Jr., and Benson, for early operations.

One can readily understand why Toynbee, Von Troeltsch and the writers of that day should have taken the position they did against any operative measures. It is to be remembered that anæsthesia was unknown then and antisepsis was undreamed of, so that operations were painful and even the simpler ones were usually followed by suppuration. Furthermore, the progress in the methods of operating in such cases is interesting. The first attempts at removal consisted in an effort to reduce the growth by the application of nitric acid or other escharotics. This was followed by the use of sponge or laminaria tents to dilate the space between the tumor and the canal wall and set up an inflammatory process to cause a breaking down of the growth. Next came an effort to bore through the bone with an iron wire at white heat and, later, the employment of electrolysis. Naturally all of these methods were terribly painful, required frequent sittings and were uncertain in their results. With the general advance of surgery came an improvement in the manner of operating. Anæsthesia disposed of the pain and shortened the time of operation; the introduction of surgical cleanliness made such operations perfectly safe except for the slight danger that accompanies anæsthesia; an American otologist, Dr. Mathewson of Brooklyn, taking up the American dental engine, adapted special drills to it and found a rapid and easy way of removing the bone; and others have more recently by the aid of the mastoid chisel and gouges succeeded perhaps even better.

I expected that a review of the literature would disclose some other reason for the remarkable unanimity with which writers have continued to apply Toynbee's dictum, but if any such reason exists I have failed to find it after a very thorough search. I have examined the records of 139 cases that have been operated upon and in no single instance did any serious complication result from or follow the operation. In a large proportion of these cases a suppurative otitis media existed at the time of operation or had been present before and the operation was done during a period of its quiescence. Every case is reported to have been cured, immediately or ultimately, both as to the removal of the obstruction and the relief of the otorrhœa or the deafness, whichever may have been the cause for intervention. In a very small percentage of cases an infective otitis media was produced by the operation through careless or unavoidable injury to the tympanic membrane. In every case of this kind, however, the discharge was promptly controlled and the membrane soon healed. Occasionally the operation was successfully performed after the pent-up secretions had started an active disturbance in the mastoid. Several similar cases are reported, not operated upon however, in which death resulted from meningitis or mastoiditis followed by general infection, where the mastoid disease was probably correctly traced to the obstructing mass in the canal.

There have been a much larger number of cases operated upon than have been reported, for in some parts of the world, particularly in England, it is a common affection. Undoubtedly, too, there have been a number of failures, descriptions of which have not sought the light of publication, but allowing for these possibilities and giving consideration to the points mentioned above, I think one is justified in taking issue with the text-book statements and in urging, as others have done before, surgical treatment of these growths without waiting for them to become particularly, and perhaps dangerously, troublesome. When done early the operation is much simpler and the operator has much better control of the field than when the canal is completely obstructed by the growth. When otorrhœa exists its treatment is rendered more easy and its cure more

certain and permanent by the prompt removal of the growth even though there be a passage-way still sufficiently large to permit egress of the pus. When there is no history of purulent otitis, either present or past, it is still better to operate early for we thus save the patient, in the words of Benson, "the dreadful misery of growing deaf, with all its isolation and despondency."

Exhibition of Patient.—In this connection I would like to show a case of exostosis occurring in a man 45 years of age, in good health, without any other evidence of osseous hyperplasia. His right ear is perfectly normal. The left external auditory canal is almost completely obstructed by a sessile exostosis springing from the posterior wall about 10 mm. from the tragus; there is only a narrow slit between the growth and the antero-superior wall. There is no history of any previous otorrhœa, but the case corresponds to those described by Mr. Fields who so frequently found these growths occurring in persons addicted to excessive bathing or diving in salt water. This man tells me that since early boyhood he has been fond of swimming whenever the opportunity offered. His bone conduction for tuning forks is perfect but the obstruction to aerial conduction is so great that he can only hear very loudly-spoken words or the watch on close contact. I have advised extirpation of the bony obstruction.

Discussion.

Dr. Randolph.—I think it should be remembered, in connection with these exostoses, that they are very slow-growing. We may see one of a certain size and if permitted to examine it again ten years later find that there has been almost no increase in size. Dr. Reik reminded me this evening of a case which I saw at the clinic last year in a patient who could hear fairly well and who was having no trouble. I do not remember that I advised an operation upon him, at least I did not impress upon him that it was important to have it done and he went away with the impression that it ought not to be done. The point I wish to impress is this, that these cases should be seen from time to time before an operation is done. I have seen six cases and have operated upon two, in both of which the canal was occluded by the growth. It is astonishing how well these patients may hear even after the growth has passed across the lumen of the canal.

I think one of the reasons why otologists have generally refused to operate upon these growths is the intense reaction that may follow the operation. I remember a case which came to me a year ago after an operation by an otologist in this city where there was an intense reaction and where not only the whole auricle but also the side of the head was swollen. The operation had been performed with the dental engine. The reactions following operations in the external auditory canal are often very intense no matter how perfect the technique of the operator, for it is a difficult place to secure satisfactory drainage, and this being the case nothing would be more likely than an infection of the middle ear from the canal. I would like to have Doctor Reik give the subsequent history of the boy whom I saw last year, for I believe he said that he had seen him quite recently and that an inflammation of the middle ear had set up. Of course where an obstruction to discharge is present the indications for operation are strong. In such a case I should not hesitate to operate, but I believe if I should see another case of exostosis I would be rather inclined to keep the case under observation for a time and watch its behavior and not operate unless it was to make an exit for a purulent discharge or in case there was profound deafness in the fellow ear.

Dr. Reik.—Would you operate upon such a case as is represented by this patient I have just exhibited?

Dr. Randolph.—I am unable to say as I have not examined him very carefully.

Dr. Hurd.—Did you not present a similar case a year or so ago before this society as one not calling for an operation?

Dr. Randolph.—Not exactly, as the man whom I exhibited a year ago had an exostosis which did not quite block the canal, and if I remember aright his hearing was good on that side.

I would like to refer again to the operation in these cases and ask Dr. Reik what operation he prefers. I perforated the mass in my cases by the slow action of silver nitrate and while the treatment consumed a good deal of time I was satisfied at getting the canal perfectly clear and that too without any discomfort or risk to the patient. At no time was there reaction of any moment and no closing of the canal by swelling. I am opposed to the use of other cauterizing agents than silver nitrate.

Dr. Reik.—The patient Dr. Randolph inquired about, and upon whom I operated recently, serves as an excellent illustration of the point made in my paper, that it is important to remove these exostoses before they cause any pronounced trouble. At the time Dr. Randolph saw him he was troubled only by partial deafness and operation was not advised. A year later the patient came to me with a foul smelling otorrhœa and other symptoms pointing to inflammation of the middle ear with commencing mastoid involvement. It was necessary to remove the obstruction at once to secure proper drainage of the tympanum, and this being done the otitis media was soon cured.

Of course, one can operate upon such a case even after serious complications have arisen but although he may be successful in removing the growth and in checking or curing the inflammation he can never thoroughly repair the damage done to the drum membrane and ossicles.

In regard to the method of operating, my own preference is for the chisel and mallet wherever possible; the dental drill may be serviceable in some cases. If the growth is large or situated deep in the osseous portion of the canal the operation is rendered much easier by following Dr. Knapp's suggestion of detaching the auricle and drawing it forward, as in the mastoid operation, so as to expose the tumor at a much shorter distance from the operator. Having completed the removal of the exostosis the auricle is stitched

back in place, an antiseptic dressing applied, the canal plugged with iodoform gauze and the patient kept quiet for a few days. This plan was followed in my case, the dressings in the canal being changed frequently on account of the otorrhœa, and the patient sent home well at the end of a week.

I can see no good reason for deferring operation upon the patient before you. The auditory canal is almost completely blocked and his hearing reduced to a small fraction of the normal. It is true that his other ear is perfectly good but inasmuch as an operation under such circumstances is a simple and safe procedure why not try to restore his hearing on this side?

Dr. Hurd.—I fancy the general surgeons would operate without question in all these cases.

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

Monday, October 6, 1902.

The meeting was called to order by Dr. Hurd and the election of officers postponed for a later meeting.

The Treatment of Aural Exostoses. Dr. Reik.

See this Bulletin, page 82.

The Importance of a More Radical Operation for Carcinoma Cervicis Uteri as Suggested by Pathological Findings in the Parametrium. Dr. Sampson.

See Bulletin for December, 1902, page 299.

Discussion.

Dr. Hurd.—I understand that Dr. Tausig of St. Louis, a former pupil of Wertheim, is here. I would ask him to speak on this subject if he is willing to do so.

Dr. Tausig.—I think there can be no doubt but that Dr. Sampson has developed a very interesting and new form of operation. Of course the point is mainly that he has made it even more radical than Wertheim's which up to this time has been the most radical one proposed. He wants not only to remove the glands but the tissue between the glands and the cervix, and I think the point he has brought out about the mortality will, of course, be the deciding feature.

We have to consider every case that is lost during operation as counting against that operation, just as much as where the disease returns it is counted against the less radical treatment. In our attempts to make the operation more radical we must be very careful not to reduce the sum total of cures.

Professor Wertheim has, of course, developed the technique of his operation so that while his mortality at first was something like 33 per cent, in his last 30 cases it was only 10 per cent. He had a large number of fistulæ develop and I know of one case where the kidney condition afterwards was responsible for the death of the patient, so now, in the last few cases, where the ureter was surrounded by cancerous tissue, he has resected it and he does not hesitate to resect the bladder and rectum where it appears necessary.

October 20, 1902.

The meeting was called to order by the president, Dr. William Osler.

Aneurism of the Aorta. Dr. McCrae.

One of the cases shown at the last meeting reminds me to bring this case to-night, which shows features of change in the signs of an aneurism of the aorta. The patient is a colored man, 49 years of age, first admitted in December of 1901, complaining of cold and shortness of breath. He had rheumatism at eight years of age, had been a light user of alcohol and was much exposed to the weather by his work. There is no history of lues. His trouble began with a cold and cough, but he continued at work in spite of these and pain in the left thorax. On examination there was a definite heave of the manubrium but no visible pulsation seen in the back and there was nothing definite felt on palpation. The radial pulses were equal and the lung examination was negative. The only symptoms then were pain and cough. The only sign was the heaving pulsation. He was discharged after ten days' stay in the hospital perfectly comfortable and apparently well.

In July of 1902 he again caught cold, as he said, and had a husky voice with attacks of dyspnœa. He came in again on the 15th of October complaining as at the last visit, but on examination we found a marked change. He had considerable dyspnœa, quite marked stridor, husky voice and a peculiar brassy cough. On the right side of the sternum there was a very prominent visible pulsation that could be seen ten or twelve feet from the patient. There was an area of definite local pulsation in the third right interspace with a diastolic shock on palpation. On percussion there was dulness, but nothing unusual was noticed on auscultation. The sounds over the lungs were exceedingly interesting. Over the upper right front there was marked tympany, while over the left the note was normal. Next day the prominence was still visible, but there was dulness over the upper left front and the expansion was diminished to the left. Between Saturday and Sunday there was a marked alteration of these signs. The prominence visible to the right had disappeared completely and a slighter prominence become visible to the left. The dulness to the right disappeared and the diastolic

shock with it. He now shows dulness on percussion and well marked diastolic shock on palpation.

The heart condition was also changed. On admission there was no point of maximum impulse to be made out, but there is now an impulse outside the nipple line, which one can see several feet away.

Probably the most interesting change is in the lung sounds. On admission we interpreted those as follows: The area of tympany on the right was probably due to pressure. On the left, where there was diminished expansion, we thought the bronchus was pressed upon and the air space reduced. In the last twenty-four hours the right lung has improved a great deal, but the left lung dulness has increased until there is flatness from apex to base throughout the back. There is nothing definitely felt in the episternal notch and no tracheal tug. Within the last two hours a systolic murmur has appeared which is heard throughout the right side of the chest and the left radial pulse shows a lower pressure than the right.

The points of special interest are the change in what might be the aneurism itself. The man showed a marked pulsation on the right, associated with diastolic shock, which we thought was due to an aneurism. Three days later there was disappearance of the shock, dulness and pulsation, with later a transference of these to the opposite side of the chest.

Discussion.

Dr. Osler.—We have had one or two instances of the disappearance of pulsating tumors. Some of you may remember the old Swede upon whom Dr. Finney operated two years ago. After wiring of the sac the tumor disappeared and the prominence almost completely left before he went out of the hospital. What is known as dynamic pulsation, seen most often to the right of the sternum in aortic insufficiency, may disappear. In cases of ulcerative endocarditis with marked anæmia there may be a pulsation most suggestive of aneurism, but which, as in a case in Ward E some years ago, may disappear.

Aneurism of Upper Part of Thoracic Aorta. Dr. Osler.

An exceedingly interesting aneurism came to section today, which illustrates the obscurity of some cases of thoracic aneurism. A man, 45 years old, was admitted first in February of last year with pain in the back and side and shortness of breath, which had lasted since the summer of 1900. In November of that year and throughout the winter he had dyspnœa and had to sleep in a sitting posture. There was no cough and no dysphagia. There was a diffuse shock, or impulse, best felt to the left side of the sternum, but no localized pulsation, no diastolic shock and the second sound was not accentuated. He left the hospital somewhat improved, but was admitted a second time in August, 1901, with the same symptoms, but with some dulness to the left of the manubrium. There were also much pain and tenderness in the abdomen at that time. His third admission was on August 20 of this year, after he had had several fainting spells and had become profoundly anæmic. He had a diffuse impulse in the chest, but no localized shock and the diagnosis of aneurism was made more from the shortness of breath, the dyspnœa, the pain in the chest and the diffuse impulse. On the 14th of October he vomited blood and this was repeated on the 15th and 19th, when he also passed a large quantity of blood from the rectum. He became very anæmic from the loss of blood and died on the 19th.

The aneurism is an interesting one and illustrates the differences between the aneurism which causes only symptoms and the aneurism which causes only physical signs. An aneurism in the ascending part of the arch may cause neither physical signs nor symptoms; before the patient has any symptoms, or the aneurism is large enough to produce physical signs there may be rupture.

Aneurism of the transverse portion of the arch as a rule produces both symptoms and physical signs. It presses upon the nerves, upon the windpipe and the gullet, producing pain and other symptoms. It comes forward and erodes the ribs or sternum and presents a prominent tumor.

Aneurism of the terminal portion and of the thoracic aorta produces symptoms but often no physical signs. This man had such a condition. The specimen shows a moderate dilatation of the arch and at the terminal portion, or the beginning of the thoracic aorta there is a sac the size of a small orange which projects backwards and is closely adherent to the spine, which is slightly eroded. We were very much puzzled to account for the bleeding. There was no dysphagia and we did not think it could press on the gullet. The autopsy showed an ulcer of the stomach with an eroded artery.

Exhibition of Cases showing the Effect of X-ray Treatment of Skin Cancer. Dr. Gilchrist.

Dr. Gilchrist exhibited patients and lantern slides to show the improvement which had resulted in three cases of skin cancer after the use of the X-ray.

Cryoscopic Test of Urine. Dr. Tinker.

To appear later.

November 3, 1902.

The meeting was called to order by Dr. Hurd.

The following officers were unanimously elected for the ensuing year:

President, Dr. J. Whitridge Williams.

Secretary, Dr. M. B. Tinker.

Typhoid Spine. Dr. McCrae.

The first case to be shown to-night is one that presents two rather interesting features, one of which is rare (it being only the seventh instance we have had in the hospital), and the other one which has occurred but once in our hospital records. The patient has suffered a long continued attack of typhoid fever without special features, except abdominal

pain with hiccoughing and vomiting. His convalescence was very slow and he objected to being discharged from the hospital although he had been kept in for a long time. He is readmitted with the history that he had been at work for a week, when, on October 25, he complained of severe pain in the back, associated with the ordinary features of what we term typhoid spine. There is little question that the man is an example of the condition described under that term.

The second feature is a rhythmical contraction of the abdominal muscles which you can readily see. We found on examination that the abdominal muscles were contracting at the rate of about seventy-five to the minute, and, at first, the condition suggested a transmitted pulsation from the aorta, but it was found to be faster and not synchronous with the pulse. It was so marked to-day that on putting the two hands in the flanks they were appreciably moved in and out by the contractions of the recti muscles. There can be no question I think that the condition is a neurotic one, a hysterical contraction of the muscles. When he sleeps the contractions stop. To-night I went into the ward and found him asleep and after he awoke it was fully five minutes before the contractions appeared again. We tried administering a few whiffs of chloroform to see if that stopped them, but it seemed instead to aggravate them.

Aneurism of Abdominal Aorta or Coeliac Axis. Dr. Clarke.

Dr. McCrae asked me to show this case, which presents some interesting physical signs and a mistake in diagnosis which was made sometime ago. The patient is a German, 43 years of age, who for the past fifteen or twenty years has been a pilot; has had no specific disease, but has been a heavy, though irregular, drinker. He was well until five years ago, when he first noticed a severe pain across the lower part of the abdomen. This was paroxysmal and lasted about five weeks. He was treated by a doctor, who called it either neuralgia or rheumatism. Poultices were used and he recovered temporarily. He had similar attacks lasting only one or two days during the next few years, but last February had another attack which lasted six weeks and kept him in bed. Feeling better after this he returned to work during April and May. About the first of June the pain returned and has been constantly present since; the patient has required 3 or 4 grains of morphia during the 24 hours to obtain comfort. The diagnosis of his physician was at first lumbago, but later this was changed to "kidney trouble." He was taken to one of the hospitals of the city and operated upon, but though I visited the hospital this afternoon I was not able to see the surgeon, nor to find the history. The pain he has is across the lower third of the abdomen, extending across the flanks and up the back and sometimes down into the region of the testicle. The diagnosis upon which the operation was based was nephrolithiasis. In February he first felt a throbbing in his stomach which has increased and at times given a great deal of discomfort, causing some shortness of breath.

He was admitted four days ago, apparently in great pain. Examination shows that the heart is considerably enlarged, there is distinct heaving of the whole præcordia and over the whole heart there is a to and fro murmur with maximum intensity in the aortic region, where it has a loud blowing sound. His abdomen shows a definite heaving of the ensiform and the epigastrium, and on palpation a tumor 6 to 8 cm. in diameter can be made out, which shows pulsation of an expansile quality and a definite thrill. A bruit can be heard, but no diastolic shock on auscultation. In the right back, in the region of the 10th, 11th and 12th dorsal ribs, when the patient lies on his face, there is a distinct bulging, with a visible and palpable pulsation which at times seems to be expansile, giving the appearance of an aneurism pressing backward. The most interesting point in the physical signs is, however, that when the patient sits up the pulsation in the back entirely disappears, and in its place is seen a distinct systolic retraction. The pulse in the femorals is not markedly different from that of the radials. The patient says that after the operation referred to he was told that the trouble was "a blood tumor," whereas prior to the operation he was told that it was "kidney trouble." Evidently they made the diagnosis of aneurism at the time of operation. Our diagnosis is aneurism either of the abdominal aorta or the cœliac axis.

Discussion.

Dr. McCrae.—Some of the cases of aneurism we have seen lately have presented signs difficult to explain. This case shows signs in the back and on the right side instead of the left as might be expected and a pulsation which disappears when the patient sits up or lies flat on his face, while to the left side there is a definite systolic retraction which we usually describe as indicating adherent pericardium.

Exhibition of Two Cases of Appendicitis with Obstruction. Dr. Follis.

These two patients which I wish to show to-night are cases of appendicitis with obstruction, one before and one after operation. I would like to say a few words particularly about the treatment of such cases.

The first patient is a girl 15 years old, who came into the hospital May 28, 1902, with a typical history of appendicitis of three days' duration. Her attack began with nausea, vomiting, constipation, abdominal pain and tenderness. We operated and found an abscess rather far towards the middle line among the coils of small intestine. It was just the kind of a case in which one might expect obstruction from the gauze packing. The appendix was removed and a large gauze drain was packed into the site of the abscess. Patient did well for 48 hours when she developed obstruction with paroxysms of pain, vomiting and constipation. For 24 hours attempts were made to move the bowels with cathartics and enemata but this was impossible. The pulse increased in frequency gradually from 110 to 160. As her condition had become very serious she was taken to the operating room and an enterostomy was done. An incision was made

through the left rectus muscle and the first loop of distended bowel found was brought into the wound and opened immediately. At this time, I am sure we soiled the peritoneal cavity and it was with this in mind that when we had to do an enterostomy again we used the procedure which I shall describe. She did perfectly well after this operation and the foul smelling fluid bowel contents which one always finds in obstruction cases was replaced within 24 hours by normal intestinal contents. Patient did well for 18 days, at which time another obstruction occurred, although the fæcal fistula was discharging freely until 48 hours before the second obstruction. This second attack of intestinal obstruction was apparently due to the occlusion of another loop proximal to the site of the loop we had first opened. The abdomen was opened again through the right rectus muscle. This time, having in mind the soiling of the peritoneum, we used a procedure which so far as I know is new. We brought the bowel up to the abdominal wall, packed iodoform gauze around it and took some catgut sutures through the bowel, through the gauze, through the parietal peritoneum and back again. This held the bowel in place and prevented soiling of the peritoneum after it had been opened and had collapsed. After each of these operations the bowels began to move per rectum within 48 hours, which seemed to show that the obstruction was due in part at least to distension of the bowel. As soon as the distension was relieved, the obstruction was relieved enough to have normal movements of the bowels per rectum. The patient did well for about two weeks and the fistulæ began to close when she suddenly developed another obstruction after taking some indigestible food and it was necessary to open one of the enterostomy wounds. Since that time she has had no trouble and there have been no signs of obstruction. I feel sure had we tried to relieve the obstruction the patient would have succumbed.

The other patient that I wish to show is a boy who had very marked symptoms of obstruction before operation. He was sent in by Dr. Bloodgood with a history of acute abdominal pain and vomiting of 12 days' duration. Vomiting was marked from the beginning and not like that of an ordinary attack of appendicitis. Usually in appendicitis there is vomiting at the beginning of the attack which does not continue. This boy's vomiting was continuous; there were paroxysms of pain from the beginning and he was admitted in very bad condition. He had a great deal of distension, visible peristalsis and all signs of acute obstruction. In fact, the diagnosis of appendicitis was not made until the operation. We found a pelvic abscess which was opened and evacuated. The entire operation did not last over 20 minutes. We did not look for the appendix but simply brought a loop of distended bowel into the wound and sutured it in the way that I have mentioned. This was opened in three days. He made an uninterrupted recovery. His fistula and abscess wounds were closed within 30 days after the operation and he is now perfectly well. This is another case in which had we tried to relieve the obstruction or to do anything else except make an artificial anus, the patient would have surely succumbed. The symptoms of obstruction disappeared and the bowels moved per rectum within 48 hours after each enterostomy had been performed. I wish to emphasize the fact that patients with obstruction often die because too much is done at a time when they are exhausted and in a very critical condition from their obstruction. An enterostomy is indicated at this time and this method of doing the enterostomy has certain advantages over other methods which have been used.

In my first case, the first enterostomy was done by simply packing gauze about the loop of distended bowel which was brought up to the surface of the peritoneum and opened longitudinally. I feel sure there was considerable soiling of the peritoneum at this time. This was prevented in the second enterostomy by the method which I shall describe later.

In the second case, the bowel was not opened for three days as the obstruction seemed to be relieved by evacuation of the abscess. This enterostomy also healed spontaneously within three weeks.

The method in detail is as follows: A loop of distended bowel is brought up to the surface of the parietal peritoneum and iodoform gauze is packed around it to wall it off from the general peritoneal cavity, leaving a space on the surface of the bowel to be opened immediately. Catgut sutures are taken through the bowel, iodoform gauze and the parietal peritoneum at the edge of the wound and back again through gauze so that the peritoneum covering the bowel and the parietal peritoneum are brought firmly together around the edge of the wound with the gauze between them. These sutures are then tied and the bowel can be opened immediately. A stomach tube can then be introduced and the bowel washed out thoroughly both above and below the opening. The gauze is taken out in from five to six days and the granulating sinus is left to heal from below. This is not possible when a tube is sutured in the wound. If a loop of bowel is brought out as is generally done and gauze passed through its mesentery it is necessary to close it subsequently or in some cases even to resect the bowel and do an end-to-end suture. The method I have described has the following advantages:

First. When the distended loop of bowel is emptied it does not fall away from the parietal peritoneum and allow its contents to run back into the peritoneal cavity.

Second. The operation is simple and can be done quickly.

Third. The bowel can be opened immediately without danger of soiling the general peritoneal cavity as might occur if the gauze alone were used or if the bowel were sutured to the parietal peritoneum without the gauze.

Fourth. If we may judge by these cases, these enterostomy wounds close spontaneously and do not necessitate a second operation to close the bowel. In these cases the enterostomy wounds all healed within three weeks.

Fifth. It is possible to introduce a stomach tube and irrigate the bowel for some distance above and below the opening. Cathartics, stimulating and nutrient enemata can

also be given by the opening. This is not possible when a tube is sutured into the bowel, as is frequently done in these cases.

Sixth. The same procedure can be used in doing an enterostomy when operating for general peritonitis with distension.

Discussion.

Dr. Cullen.—I think Dr. Follis is to be congratulated on his success in these cases. I followed with a great deal of interest his treatment of strangulated hernia last year and the excellent results he obtained in those cases have evidently led to the adoption of a similar line of treatment in the cases of obstruction. I would like to ask Dr. Follis what will probably become of the appendix in his second case and whether any further trouble is to be anticipated. Last spring I was called in to see a boy 14 years of age giving a history of operation for appendiceal abscess three years previously. At this time the appendix was removed. He had never felt perfectly well since operation and on several occasions had elevation of temperature and was forced to remain in bed for a few days after blows over the appendiceal region. On examination I found a distinct area of induration beneath the old abdominal incision. On opening the abdomen the old site of the appendix was free from adhesions but between the cæcum and abdominal wall about 3 cm. above the appendiceal stump was a small abscess cavity.

I am not perfectly clear as to how Dr. Follis brings the gauze to the abdominal wall and would be glad if he would give us further details of his method of procedure.

Exhibition of Pathological Specimens. Dr. MacCallum.

1. Thoracic Aneurism.—The first specimen consists of the thoracic viscera of a man in whom during life the symptoms pointed definitely to the presence of an aneurism of the thoracic aorta. There was a large area of dulness extending on both sides of the median line posteriorly, intense throbbing pain throughout the back, and an area of anæsthesia in the region supplied by several of the dorsal nerves on the left side. The heart was displaced toward the right side and there was evidence of compression of the left lung. A sudden and extensive hæmoptysis resulted in the man's death.

At autopsy, the right pleural cavity was but little encroached upon, but the left was partially filled by a large mass, which lay in the posterior mediastinum and which caused extreme compression of the lung. The heart was flattened antero-posteriorly and pushed somewhat to the right, while the left lung, which was densely bound by adhesions to the ribs, was almost airless, its lower lobe being flattened out into a doughy mass about 1 cm. in thickness.

I have here the thoracic portion of the spinal column with the ribs and the contained viscera. The heart shows no especial pathological alterations but the aorta is greatly dilated and very sclerotic, even in the ascending portion of the arch. From the descending portion there opens backward, by a wide and much elongated opening, the large saccular aneurism, which is in large part filled with a thrombus mass. Below the opening of the aneurismal sac the remainder of the aorta is also very sclerotic. The sac is very intimately adherent to the vertebræ and ribs, and on tearing it away it is found that the posterior wall has been completely destroyed and the thrombus mass lies directly upon the vertebræ and ribs, which are deeply eroded in the characteristic way. The thrombus is in part friable and soft but the more central part is pinkish-white and elastic and distinctly laminated. No evidence of organization is to be found.

The left bronchus passes over the sac and is greatly compressed— a fact which probably accounts in part at least for the collapsed condition of the lung. Passing behind this and a little to the right is the œsophagus which is also much compressed by the sac and in the region of the bifurcation of the trachea there is a large hole opening into the aneurism through which the fatal hæmorrhage occurred.

2. Gummata of Liver.—The second specimen is from a negro who entered the hospital complaining of swelling of the legs and abdomen. He gave a definite history of syphilis, and during his stay in the hospital the ascites and œdema of the legs increased. At the autopsy the main interest centered in the liver, which was extremely small and distorted by contracted scars. It was found to be bound to the diaphragm by a large mass which extended through about the vena cava and invaded the lungs. On removal of these viscera together it was seen, as is still shown in the specimen, that the mass compressed the vein almost to its occlusion and that below this point the vena cava was distended throughout its course by a dark greyish-red thrombus mass which extended into the renal veins and other branches. Section of the liver shows that this large mass is composed of a homogeneous, yellowish-white material which is extremely elastic—almost like rubber in consistence, and not quite opaque. It extends some way into the liver, but there are also many other smaller masses of the same nature scattered through the organ and surrounded by radiating scars. These are without doubt gummata and in the elastic condition which gave origin to the name gumma or rubbery tumor. Similar masses occur in the retroperitoneal and peritracheal glands and spleen. Besides these masses in the liver with their associated scars, there is a diffuse cirrhosis, which shows microscopically a quite extensive degeneration of the liver cells with some attempts at regeneration.

The thrombus in the vena cava shows a beginning organization but it is apparently of long standing—no doubt the œdema of the legs was primarily caused by the compression of the vein to which the occlusion by the thrombus was added later.

3. Thrombus.—The third specimen also shows the result of occlusion of a vessel by a thrombus mass. It consists of the heart together with the cervical and axillary veins and the aorta of a person who had been a patient in this hospital for several years with symptoms of mitral stenosis and occasional evidences of the stoppage of a vessel. At one time there

lodged an embolus in the popliteal artery, at another the jugular vein became thrombosed and cord-like. Finally, with a sudden severe pain, with lividity of the legs and abdomen and some paresis in both legs, she died. At the autopsy it was found, as you see in this specimen, that beside the extreme mitral stenosis, there was a tricuspid stenosis of almost as high grade. The aortic valves were also thickened and contracted, producing, no doubt, an aortic insufficiency as well as stenosis. There was no thrombus in the heart except a small one in the left auricular appendage. The left jugular, when dissected out, was found to be converted into a fibrous cord with several narrow canals from which fluid blood could be squeezed. The same condition was found to exist in the left subclavian vein.

One can see in the sections which I have placed under the microscope that in this fibrous cord we have really the original vein wall distended by a fibrous mass which no longer contains any thrombus but which is perforated by a great number of wide, irregular canals lined by a single layer of endothelium only. Besides these there are well defined small arteries and veins crossing through the tissue. It seems possible that the large irregular channels may have arisen as clefts in the thrombus later lined by an overgrowth of endothelium from the main vessel, while the other vascular channels have arisen from the vasa vasorum.

As indicated by the pain and lividity in the legs, the abdominal aorta was completely occluded by a thrombus, which extended from a point about 3 cm. above the bifurcation, down to Poupart's ligament on both sides. In the left femoral artery the thrombus was old and partly organized but otherwise it was not possible to determine exactly the starting point for the occlusion of the aorta. The last two lumbar arteries are included in the thrombus and, as you will recall, there was slight paresis of the legs, but although the question of paralysis after occlusion of the abdominal aorta is of great interest, since the experimental work in rabbits in which occlusion of the abdominal aorta is produced after an hour's paralysis of the legs, we were not able to examine the spinal cord.

Dr. Welch reviews the subject in his paper in Albutt's System of Medicine and regrets that of fifty-seven autopsies on such cases, in only one was there any microscopical examination of the cord. In that case there was a degeneration of the anterior and posterior nerve roots.

Discussion.

Dr. McCrae.—These cases clinically were all of very great interest. The one of occlusion of the inferior vena cava hardly seemed to give the view that the change in the vessel accounted for all the symptoms. The swelling of the abdomen and œdema of the legs dated back too far and was probably due to cirrhosis of the liver. The last case reported was of exceeding interest with reference to the diagnosis of the tricuspid disease. The presystolic murmur was heard always over a wide area but there were no special signs in the veins of the neck or about the lungs and a clear diagnosis was not made. There seemed little question during life as to the diagnosis of embolism in the artery of the leg and the sudden onset of great pain and coolness of the leg confirmed the diagnosis.

Report of Gynecological Cases. Dr. Cullen.

This evening I wish to briefly report four rare cases of uterine myomata which we have seen in the course of the last few months.

Case 1.—*A large myomatous uterus with a subperitoneal nodule molded to and filling the pelvis. Strangulated umbilical hernia. Removal of hernial sac. Hystero-myomectomy. Recovery.*

Mrs. F., seen in consultation with Dr. Scherzer on August 10, 1902. The patient had noticed an abdominal tumor for several years and had also complained of an umbilical hernia. The hernia came down occasionally but was reduced with ease. On August 11 it protruded and it was impossible to return it. When I saw her the pulse and temperature were perfectly normal but at the umbilicus there was a reddened area fully 5 cm. in diameter and surrounded by a zone of induration fully 15 cm. across. The tissues here were markedly œdematous and it looked as if the skin would soon become necrotic. On palpation a large mass could be felt filling almost the entire abdomen. Above it extended to a point midway between the umbilicus and zyphoid cartilage. On vaginal examination the entire pelvis was found to be filled with a hard myomatous mass. Immediate operation was advised. Fearing infection we completely isolated the indurated area around the umbilicus by stitching gauze over it. An elliptical incision was made, removing the entire indurated area. The sac was found to contain nothing but omentum. This, however, was deep red in color and would soon have become necrotic. The large tumor filling the abdomen and pelvis proved to be a myoma. The main tumor was liberated with little difficulty, but projecting from the posterior surface of the myoma was a large secondary myomatous growth which filled the pelvis completely and was molded to the pelvis. It was impossible to liberate this growth until the uterus had been completely freed from its cervical attachment. The patient made an uninterrupted recovery. When I saw her on November 3 she was in excellent health.

This specimen is particularly interesting from the subperitoneal myoma conforming so definitely to the outline of the pelvis.

Case 2.—*Myomatous uterus, very large pedunculated submucous myoma filling vagina, also with a large subperitoneal nodule adherent to the right ureter and blood-vessels at the pelvic brim. Complete hysteromyomectomy with great difficulty in delivering the submucous myoma per abdomen. Accidental temporary ligation of the right ureter. Recovery.*

Miss R., seen in consultation with Dr. F. Gavin on October 24. The patient was 46 years of age. She menstruated at 13 and has always been regular. For the last five years the

menstrual periods have been prolonged and profuse and there has been some leucorrhœa. About this time she felt a small nodule the size of a walnut in the lower abdomen. At present she is very anæmic, constipation which has always troubled her has been more severe during the last year and for three years there has been frequently painful micturition. On abdominal examination distinct bosses can be felt rising to the pelvic brim and on vaginal examination a large mass, the exact dimensions of which cannot be determined, fills the vagina. This mass appears to be about the size of a cocoanut.

Operation October 25: A median abdominal incision was made, extending almost from the umbilicus to the pubes. A myomatous uterus was found. The greater part of the mass extended below the cervix. The left tube and ovary were tied off and then the round ligament secured. The right side was treated in the same manner but here a subperitoneal myoma about 5 cm. in length and irregular in outline was found. This lay along the course of the iliac vessels and was intimately adherent over the site of the ureter. Its attachment to the uterus was by a muscular pedicle 5 mm. in thickness. We severed this subperitoneal myoma from the uterus and left it *in situ* as its removal at this stage of the operation was impossible. The uterus was drawn still further upward, the bladder was pushed down until the vagina was exposed. The vagina anteriorly was drawn up between two pairs of artery forceps and cut between. Once in the vagina, which by the way was greatly drawn out and distended by the submucous myoma, we were enabled to cut under sight from before backward and in a short time had the uterus and the vaginal cuff entirely free. On making traction, however, it was impossible to dislodge the submucous myoma which filled up the entire vagina and was attached to the uterus by a pedicle fully 2.5 cm. in diameter, but after making gentle but steady traction and pressing downward upon the bladder the myoma was dislodged with a loud sucking sound. Had we not been able to liberate it in this way we should certainly have applied obstetrical forceps. Attention was now turned to the myoma in the right side and to the right tube and ovary. The peritoneum over the myoma was split, and the myoma pealed out as gently as possible. In the meantime, however, we found it necessary to control the right ovarian vessels. This was somewhat difficult. After removing the myoma we examined the right ureter and found it included in the stump with the ovarian vessels. The vessels were picked up, the previous sutures cut and the ureter liberated. The raw surfaces on the vaginal margin were controlled with catgut and the opening in the vaginal vault narrowed down until it was about 2.5 cm. in breadth. A gauze drain was laid up to the brim of the pelvis on the right side to catch any urine should extravasation take place from the previously constricted ureter. This gauze of course was covered over with peritoneum and was accordingly extraperitoneal. Another piece of gauze was dropped down into Douglas's sac as a safeguard should there be any slight sepsis, as it was impossible to thoroughly cleanse the vagina prior to operation. The patient stood the operation well.[1]

In this case one naturally asks why was not the large submucous myoma removed per vaginam prior to the hysterectomy? In the first place, the patient was an unmarried woman and removal in such a manner was almost out of the question without first making a deep incision in the vaginal wall. In the second place the bleeding was so free during the slightest manipulation that we hesitated to give the necessary cleaning.

The situation of the ureter in this case was of especial interest as it was far out of position and right up beside the ovarian vessels. We only had a narrow chink of about 8 mm. in breadth in which to tie the ovarian vessels and it was impossible to control them in any other situation.

Case 3.—*A partially parasitic myoma receiving its blood supply chiefly from the enlarged omental vessels and a densely adherent bladder. Also associated with over 50 litres of ascitic fluid and clinically presenting the typical picture of a patient suffering from a tremendous ovarian cyst. Removal of parasitic myoma. Recovery.*

Miss P., referred to me October, 1902, by Dr. Hopkins. The patient is 54 years of age, very thin and has the typical expression of one suffering from an ovarian cyst. For several years she has been complaining of abdominal distension. The abdomen is greatly enlarged, and in the lower portion near the pubes there is much œdema. There is, however, little or no swelling of the extremities. The entire abdomen is dull on percussion but in the flanks there is some tympany. On palpation a slight wave of fluctuation can be elicited. I saw this patient several days ago but on account of a recent bronchitis operation was deferred. We, however, thought it advisable to tap, and over 39 litres of clear straw-colored fluid were removed.

Operation October 29: On opening the abdomen we obtained at least 15 litres more of free fluid, the peritoneum was thickened, the intestines were of the normal color and lying immediately beneath the incision was a globular tumor at least 16 cm. in diameter. Above the omentum was practically missing but the omental vessels had become greatly enlarged and had grown into the posterior surface of the tumor. These vessels had exceedingly delicate walls and were surrounded by little connective tissue. So friable were they that the slightest traction was sufficient to rupture arteries at least 3 or 4 mm. in diameter. The omental vessels were tied off and the tumor delivered. It proved to be a subperitoneal myoma which had become partly parasitic. It was attached to a practically normal uterus by a pedicle 4 cm. broad and 1 cm. thick. It was densely adherent to the parietal wall of the left side and anteriorly was intimately attached to the bladder from which it had received an abundant blood supply. In order to release the bladder it was necessary to sever the pedicle of the myoma and to turn it downward over the symphysis, making the point of cleavage

[1] The patient left the hospital November 29, 1902, feeling perfectly well.

on the posterior surface. Much bleeding took place but was readily controlled. The stump at the fundus was turned in by catgut sutures. The patient made an uninterrupted recovery.

In this case we had the typical facial expression of a patient suffering from an ovarian cyst. Furthermore, we found dulness in front as we would naturally expect with a multilocular cyst and also noted tympany in the flanks. In the first place the dulness was undoubtedly due in part to the omental vessels and the myoma together, forming a barrier to the intestines floating upward, and in the second place the distension was so great that the mesentery was not long enough to allow the intestines to reach the surface. The fact that the intestines were held back naturally accounts for the tympany in the flanks. The association of ascitic fluid with the presence of uterine myomata is most exceptional. In this case it was probably due to the twisting of the omental vessels by the freely movable myomatous growth.

Case 4.—*Removal of a large interstitial and partly submucous myoma. Subsequent sloughing of inner layers of uterine walls, removal of necrotic tissue followed by recovery.*

The patient, who was 38 years of age, was admitted to the Hebrew Hospital on July 14, 1902. She had noted a pelvic tumor for some years, but it gave her little concern until pressure symptoms manifested themselves and she came complaining of swollen legs which were dark purple in color. The urine showed a considerable quantity of albumin. We removed a large interstitial and partially submucous myoma nearly the size of an adult head. The uterine cavity was opened in several places. After operation she did well for several days, then her temperature rose two or three degrees and she had some headache and much nausea. The urine contained quantities of epithelial and blood casts. At the end of fifteen days there was a most offensive vaginal discharge. We examined under anæsthesia and found pus oozing from the cervix. The posterior lip of the cervix was then split to obtain free drainage and we removed fully a large handful of necrotic tissue from the interior of the uterus. Its removal did not occasion any hæmorrhage and the necrotic material was evidently sloughing uterine tissue. In this case we had stitched the uterus to the anterior abdominal wall. Consequently the line of incision was protected. Otherwise we would undoubtedly have had separation of the muscular walls with escape of purulent material into the abdominal cavity. The necrotic process apparently occupied both the anterior and posterior walls.

This is a most rare complication and the first that we have seen.

I saw this patient a few days ago and she is in good health.

November 17, 1902.

The meeting was called to order by the president, Dr. Williams.

Certain Forms of Cyanosis with Polycythæmia. Dr. Osler.

Cyanosis is of course a very common condition in hospital work. We see it in heart cases, the congenital form, and a certain number of cases of acquired mitral disease in children. Then there is an interesting group, the next most frequent that is connected with pulmonary diseases, in acute miliary tuberculosis, in pneumonia, but above all in emphysema, in which it may be most extreme, and a patient will actually frighten you by his appearance as he walks into your room. It is seen in Reynaud's disease but only about the extremities. There is a class of cases in which the cause is very obscure. Some of you remember the patient seen last winter, with abscess of the liver, on whom the impress of the hand remained for half a minute and then gradually disappeared. I have lately had under observation two cases of this obscure superficial cyanosis.

This man has been in the hospital on four occasions, each time with a history of nausea and vomiting, both of a persistant character, constipation and a remarkable grade of cyanosis. He is not nearly so bad now as he has been, but you can see that the lips are quite cyanosed and so is the general surface of the body. The cyanosis gradually disappears as he gets better but it never entirely goes. Associated with this there is a very remarkable blood condition. On each admission he has had an extraordinarily high blood count, reaching, on May 10, 10,200,000 per cubic millimeter, with a hæmoglobin as high as 115 but no change in the leucocytes. His blood pressure was 142 mm.

The second case I have under observation is in a man whose appearance at once attracts attention. His face is a livid hue, almost an indigo blue, and his hands always engorged and cyanosed. His blood count was a few weeks ago 10,000,000 per cubic millimeter. Has a slight trace of albumen and a few tube casts but his general condition is good. On very cold or moist days he gets a little stuffiness in the bronchial tubes.

This rare condition has been referred to by Dr. Cabot of Boston and Dr. Saunders of Birmingham.

An Interesting Case of Paraplegia with Recklinghausen's Disease. Dr. Thomas.

To appear later.

Discussion.

Dr. Osler.—An interesting point in these cases relates to the prognosis. In a case which has been under observation at intervals for eight or nine years with not more than a dozen patches over the body, and much of pigment there has been also the commonly associated condition of slight failure of mental powers. Has that been noted in this case?

Dr. Thomas.—There is evident mental failure.

Rectal Surgery. Illustrated with Stereopticon. Dr. Ball, of Dublin.

The Clinical Value of Blood Pressure Observations in Regulating Stimulation in Sick Children. Dr. Cook.

See February Bulletin, 1903, page 37.

Some Observations on Blood Pressure in Morbid Conditions in Adults. Dr. Briggs.

See February Bulletin, 1903, page 35.

Discussion.

Dr. Crile (of Cleveland, Ohio).—The work reported by Dr. Cook and Dr. Briggs seems to me to be of great importance. In many cases the record of the blood pressure by means of a thermometer is of as much or more importance than that of the pulse rate or temperature or respiration, notably in cases of shock, of infection, and of renal diseases. In my experience the Riva-Rocci-Cushing instrument is the most practical. Regulating the administration of certain drugs by their effects upon the blood pressure appears to be a matter of much importance. These valuable papers strongly indicate the usefulness of this new means of clinical precision.

Dr. McCrae.—I would like to express my appreciation also of this excellent work. In the medical department we are endeavoring now to obtain as large a series of observations as possible and I have been impressed by the importance of these in relation to the treatment. What Dr. Briggs has observed in regard to stimulation seems to support the ideas arrived at clinically some years ago, namely, that strychnia where it is required is usually required in large doses and for the last few years we have not hesitated to give a tenth of a grain and repeat it within an hour if necessary. In regard to digitalin we have been using it more and more for stimulation of the circulation and just as steadily during the last two years have been discarding salt solution as a stimulant. These points were arrived at by practical observation and are now being endorsed by accurate measurements.

Dr. Cushing.—Dr. Briggs and Dr. Cook are to be heartily congratulated on the results of the work which they have however only in part presented. I do not know that the Society is aware of what an immense amount of time it has been necessary to devote to this subject in order to obtain the data which have been given. It is necessary always when making early observations of this kind to do more than double the amount of work which will later be required, in order to establish those conditions in which the procedure may be of practical importance. Heretofore, the reports coming from those who have interested themselves in blood pressure observations have given a little more than isolated observations of the arterial tension in different clinical conditions. The method of plotting the records in some conformity with the clinical plotted charts on temperature and pulse rate is, I think, entirely new and enables one to graphically represent alterations in the blood pressure and so interpret them as is possible under no other circumstances. These gentlemen have this evening limited themselves to questions of stimulation, although they have worked out in addition a great many more problems of physiological interest than their present brief reports would indicate. On the surgical side of the hospital there has been a long-felt want for some form of apparatus by means of which repeated observations on blood pressure might be taken during serious operations. We have had heretofore to rely simply upon the pulse rate and upon the general character of the pulse as interpreted by the anæsthetist and, as has been emphasized to-night, pulse rate may be a very poor indication of the patient's condition. The apparatus itself, which has been considerably improved and made more portable by Dr. Cook's suggestions, possibly still leaves something to be desired. Our confrères, the physiologists, have shown us that it is in some respects an inaccurate form of pressure apparatus and consequently what we must do by means of these rough observations is to point out those groups of cases in which blood pressure observations are especially valuable and in which it might be advisable in consequence to utilize the more elaborate form of apparatus, giving both systolic and diastolic pressure, in order to give results of greater reliability. I do not wish to belittle the necessity of educating one's fingers as a means of estimating arterial tension, but in all serious conditions the desirability of employing an instrument of precision need not be discussed. It may be said also, in passing, that the employment of such an apparatus is more helpful in training the fingers for the proper appreciation of arterial tension than any amount of practice gained without the confirmation of the numerical data which the apparatus furnishes. There was a time when the patient's temperature was estimated by applying the hand to his forehead but what one desires to know are the slight variations in temperature which the clinical thermometer alone can give. Just so is it possible to tell whether a patient has a "bounding" or a "feeble" pulse, but what one wishes to know are its alterations from moment to moment or hour to hour under the multitude of conditions both therapeutic, as emphasized by these papers this evening, and otherwise, this information can only be gained by the employment of some form of blood pressure apparatus and the more simple it is the more readily it can be adapted to the requirements of bedside and operating table. Dr. Cook's relation of the method of stimulating children, entirely dependent upon the blood pressure observations made by an attending nurse, are most interesting and of great practical value. I wish once more to congratulate these gentlemen, not only upon their results, but upon the great perseverance which they have shown in obtaining them.

December 1, 1902.

The meeting was called to order by the president, Dr. J. Whitridge Williams.

Exhibition of a Case of Uncinaria. Dr. Boggs.

To appear later.

Discussion.

Dr. Futcher.—Just after Dr. Stiles' original communication on this American type of uncinaria appeared, Dr Harris, of Atlanta, Georgia, reported a case of uncinariasis which he thought was due to the old world species, but Dr. Stiles later demonstrated that the infection was due

to the American type of the parasite. Since then, Dr. Harris has been making observations on the frequency of uncinariasis in Georgia, and in *American Medicine*, of November 15, he reported that he had observed 13 cases during the summer. He believes this organism to be the commonest cause of the severe anæmias occurring in the southern states and that it is a much more frequent cause of anæmia than is malaria. Dr. Guiteras has just reported some cases from Havana and the disease is known to prevail in Porto Rico. Dr. Herrick, who was recently an interne here, has reported a case that occurred in the Soldiers' Home, Washington. Uncinariasis is known to be one of the conditions in which eosinophilia occurs, and in this case it was as high as 26 per cent.

Adenomyomata of the Uterus. Dr. Cullen.

Abstract to appear later.

December 15, 1902.

In the absence of the president, the meeting was called to order by Dr. Randolph.

Exhibition of Renal and Ureteral Cases. Dr. Young.

I wish to report to-night seven recent cases of renal and ureteral diseases upon which I have operated.

Case I.—Calculus of lower end of left ureter with stricture below it. Extraperitoneal iliac ureterolithotomy, and intravesical division of stricture.

The first is a man, aged 29, who came to me August 28, 1901, with the history that since the age of two years he had suffered with indefinite but constant pain in the region of the bladder, on the left side, and occasionally in the region of the left kidney. Every two or three weeks he had sharp attacks of pain on that side which would radiate from the bladder upwards to the left kidney. These symptoms continued up to the time I saw him. On examination I found his urine to be clear and without shreds or pus. A week later, after a sharp attack of pain, there were numerous red blood corpuscles in the urine. Examination showed the bladder to be normal. The orifice of the right ureter was normal in appearance. The orifice of the left ureter was contracted and situated in a cone-like projection of mucous membrane. To the outer side of this the ureteral ridge was replaced by a bulging prominence of mucous membrane. The ureteral catheter obtained clear healthy urine from the right kidney, but could only be passed for about one cm. up to the left ureter when it met an obstruction, and it was impossible to get any urine from this side. The diagnosis of a stone impacted in the terminal portion of the left ureter accompanied by stricture of the ureter was made. X-ray pictures were taken and showed a calculus about the size of the thumb at the lower end of the ureter where it entered the bladder. Extraperitoneal extraction of the calculus was decided on. An incision was made corresponding to the lower two-thirds of Israel's incision. I can show the incision of this patient here (showing patient), which is a more recent case, and in which the wound shows a little more clearly.

The incision was carried rapidly through the skin and muscles until the peritoneum was reached, which was stripped up from the iliac fossa and the vessels exposed. Search was then made for the ureter, which was finally found very greatly dilated, about one inch in diameter, and so intimately incorporated with the peritoneum that it was very difficult to find it. It was freed by blunt dissection to its vesical end, and there a large calculus was felt impacted partly within the intramural course of the ureter, and partly above it. The calculus was freed by the finger and pushed upward into the ureter to a point about the pelvic brim, where the ureter could be easily reached. Using the stone as a bobbin several mattress sutures of fine silk were placed in the ureter, which was then opened and the stone removed. The stone, as you see here, was oval in shape, about 2 cm. long and $1\frac{1}{2}$ cm. in diameter. Its surface shows broad furrows which have been made by the urine flowing by it. Before closing the ureter a Kelly bulbous ureteral dilator was passed from the ureter and a tight stricture of its intramural portion just beyond the location of the calculus was discovered. All efforts to pass small catheters and probes were unavailing. It was then determined to divide the stricture from within the bladder. For this purpose the bladder was drawn over into the iliac wound, the vas deferens stripped backward from its lateral wall, which was then opened extraperitoneally. After evacuating the bladder the end of the left ureter could be easily seen. The orifice was very small and surrounded by a small bulging ring. With the end of the index finger of the left hand pressing against the orifice of the ureter, I finally, by considerable force, pushed the end of the smallest dilator through the stricture until it appeared in the bladder, but was unable to push it further. A scalpel was therefore inserted into the bladder and the stricture divided by cutting along the instrument within the ureter. The stricture was found to be about 4 mm. thick and extremely fibrous. After its division the largest bougies passed into the bladder. The wound which had been made in the left lateral wall of the bladder was then sutured with about eight interrupted catgut sutures. The ureter was closed with fine silk which had been previously put in position. The abdominal wall was closed with buried silver wire sutures, leaving a small place for drainage near the lower end. The patient had an uninterrupted convalescence. Neither the ureteral or vesical wounds leaked, and now, one year after the operation, he is perfectly well, and the cystoscope shows that the orifice of the left ureter has not contracted, but remains in the shape of a slit.

Case II.—Calculus impacted in juxta-vesical portion of right ureter. Detection by ureteral catheter and X-ray. Extraction by extraperitoneal ureterotomy.

This second case is very similar to the preceding. The patient, a male, aged 25 years, with a negative past history, had, for the first time 5 years ago, a sharp cramping pain in the region of the right kidney. This lasted for six hours,

when it was relieved by a large dose of morphia. The patient was nauseated and vomited, but there was no hematuria. During the next two weeks patient had two similar attacks, but after that had no recurrence for three years. In December, 1900, the attacks began again and recurred at intervals of about one month. In these the pain was not localized in the region of the right kidney, but always began in the testicle, and from there radiated to the right kidney. In March, 1901, bloody urine was noticed for the first time, and two weeks later a small calculus was passed. After that the patient was free from symptoms for six months, when the old symptoms returned and have recurred about every two weeks up to the present time. When he came to me he complained of a more or less constant dull pain deep down in his pelvis. The physical examination was negative; the urine contained only a few shreds. The cystoscope showed a normal bladder with both ureteral orifices functioning normally. The ureter catheter was passed into the right ureter, but after going a distance of about 4 cm. an obstruction was met with which could not be passed. It was possible, however, to collect urine from this side, and it was found to be of very low specific gravity and contained very little urea. An X-ray photograph was taken and a small shadow found in the region of the right ureter just back of the bladder. Another photograph, taken with the bladder filled with a suspension of bismuth, showed that the calculus was about 2 cm. above the bladder. In September, 1902, the calculus was removed through an extraperitoneal iliac incision, as in the last case. The ureter was about the size of the little finger and very closely adherent to the peritoneum. The stone was tightly impacted at a point about 1½ cm. above the bladder, but was finally dislodged, pushed upward in the ureter and removed as in Case I. Small bougies passed into the ureter detected a stricture below the site of the calculus, but it was impossible by slight pressure to dilate the stricture, several successive instruments being passed into the bladder, fully dilating the ureter. The ureter was sutured as before, and the patient made an uninterrupted recovery. There was no leakage from the ureteral wound. The patient is now in perfect health. Urine normal.

Case III.—Chronic sinus beneath 12th rib on left side, supposed to be due to necrosis of rib. Cystoscope showed the left ureter not functioning, its orifice contracted. Five stones shown in left kidney by X-ray. Operation: nephrectomy.

This patient, a young man, aged 21, came to me complaining of a fistula in the back, which had been present for some years, and which was supposed to be due to necrosis of the 12th rib, for which he had undergone several surgical operations. His history, however, was as follows: At the age of 4 he had pain in the left side associated with swelling. After a few days this passed away, but a little later he had another attack, and during the next 5 years this intermittent pain and swelling in the left side came on at frequent intervals. At the age of 10 he had for a month considerable irritation of the bladder associated with frequency of urination. He passed no blood or calculus, however, and since then has never had any bladder trouble. During the next 5 years he suffered frequently from intermittent attacks of pain in the left side beneath the ribs, which were sometimes associated with nausea, but never radiated to the bladder. In 1897 an abscess formed in the left side, which was opened by a physician and a large amount of pus evacuated. Since then he has had a fistula which has secreted a small amount of pus, but never any urine. He has been operated on twice for his fistula, which was supposed to be due to necrosis of the rib or spine, but which has not been benefited by the operations. At present the patient has a dull aching pain referred to the left sacro-iliac synchondrosis, but not in the region of the fistula or beneath the ribs. Urine is voided normally and there is no vesical irritation. The fistula in the left side secretes only a small amount of white fluid daily. On physical examination the right kidney was found to be larger than normal and fairly movable. On the left side the kidney could be felt and there is no tenderness beneath the ribs. Just beneath the tip of the 12th rib on the left side there was a scar, in the middle of which was a small fistulous opening in which a probe passed upward and inward for a distance of about 5 cm. No exposed bone could be felt. Examination of the spinal column was negative. Genitalia normal. Urine clear, microscopically negative. Cystoscopic examination: the bladder mucosa was normal; the right ureteral orifice was large and functioning regularly, the ureteral ridge well marked; on the left side the orifice small, the ureteral ridge is not present, and the ureter is not functioning. The diagnosis of blocking of the left ureter of long standing was made at once.

An X-ray picture was taken and showed the shadows of 5 calculi in the region of the left kidney. On October 28, an extraperitoneal lumbar nephrectomy was performed. The left kidney was found higher up beneath the ribs and closely adherent to the diaphragm above, and the vertebræ within. It was surrounded by a very dense capsule. The 12th rib had to be resected, and even then the kidney was removed with great difficulty. It was small, measuring 3 x 4 x 5 cm. in size. The cortex was almost entirely replaced by fibrous tissue which formed a sac for the five stones which it contained. The wound was closed with a small drain, and the patient made an uninterrupted recovery. It is now six weeks after the operation and he is ready to go home. His urine is clear.

Case IV.—Dull aching pain for 10 years in left side. Cystoscopic examination: pus coming from the left ureter. Radiograph negative. Left lumbar nephrectomy. Dense fibrous capsule one inch thick surrounding the kidney, and several calculi.

This case, a male aged 38, had a history of pain in the left side which began about 10 years ago, and which has been more or less continuous ever since. It has always been dull in character, has never simulated renal colic, and no calculus has ever been passed. Urine has been cloudy for several years. He had suffered considerably with night sweats,

and lost 15 pounds in the last year. There has been no vesical irritation. On examination an indurated mass was to be felt in the region of the left kidney, but was not tender on pressure. The cystoscope showed the right ureteral orifice to be normal and emitting clear urine. The left ureteral orifice was surrounded by swollen reddened mucous membrane, and from it there escaped a string of muco-pus. The ureteral catheter obtained clear urine from the right kidney, but on the left side an obstruction was met with, about 4 cm. above the orifice, and no urine could be obtained. The urine contained pus but no bacteria. Numerous attempts to find tuberculosis were negative.

Several radiographs were taken, but no calculus was detected in the region of the left kidney or ureter. Tuberculin was administered, but no reaction was obtained.

It was impossible to make a positive diagnosis. The symptoms suggested tuberculosis, and the failure to find a calculus by X-ray seemed to support this. It was impossible, however, to find tubercle bacilli, and the tuberculin test was negative. On November 25, the kidney was exposed through an incision in the left lumbar region. It was found to be surrounded by an exceedingly dense, thick, fibrous capsule, in places 1 inch thick.

After cutting through the capsule a large pyonephrotic kidney containing several large stones was exposed and finally enucleated and removed with the ureter, which was divided just at its vesical juncture.

The wound was closed with drainage, and the patient has made an uninterrupted recovery. His urine is now clear and contains only a few shreds.

Case V.—Symptoms of calculus in right kidney for 23 years. Pain in left kidney for one week. Pus obtained from both sides by ureteral catheterization. Large calculus in both kidneys demonstrated by X-ray. Right lumbar nephrolithotomy.

This patient, a male, aged 42, had first a severe attack of pain in the right lumbar region 23 years ago. After that he had intermittent attacks of pain almost every day, often slight and of short duration, but frequently severe, and running down to the right groin. During the past 2 years the severe attacks occurred every 4 to 5 weeks. He never passed a calculus, and had never seen any blood in his urine. When first seen he had an acute cystitis and urethritis in which no bacteria could be found. During the following week he had four attacks, one of which was very severe, and localized in the left groin and back. Patient has improved by a week's use of urotropin. Ten days after admission the urethra still contained pus, but no bacteria could be found. Urine was cloudy in all three glasses. The prostate was indurated and the right seminal vesicle contained two hard nodules which felt like calculi. During the next week the patient began to have a dull aching pain on the left side which finally became more severe than that on the right. He had never before had any pain on the left side. Urine was still very cloudy with pus, but as the urethral discharge had largely disappeared catheterization of the ureters was performed and purulent urine was obtained from both sides.

The percentage of urea was low in both specimens. There were no bacteria to be found in either. An X-ray picture was taken, and showed a large shadow in each kidney. The diagnosis of bilateral renal calculus and pyonephrosis was made.

Remarks.—The patient was secreting only about 10 grams of urea daily, and on forced diet this amount was not increased, and it was evident that both kidneys were considerably diseased. The continuance of severe pain rendered an operation necessary, and it was therefore decided to remove the calculus from the right ureter first, and to wait until a later date to remove that from the left. On November 20, under ether, the right kidney was exposed extraperitoneally through the lumbar incision. The fatty capsule was not thickened or adherent. The kidney was larger than normal, and in places lobulated and considerably congested. In the pelvis a large stone could be felt. A small incision was made along the outer border, a forceps pushed through the cortex into the pelvis, and the blades separated, thus making a wound through which the calculus was extracted. This calculus measured about $1\frac{1}{2} \times 1 \times 1$ inches. About 25 small calculi were afterward removed with a spoon. Some of these were typical jack-stone calculi with long branches from a slender body. The kidney wound was closed around the large drainage as usual. There was very little hemorrhage and absolutely no shock following the operation, and the patient made an uninterrupted recovery. The use of the rubber tube to drain the pelvis of the kidney proved an excellent scheme, as it prevented a collection of blood-cot in the pelvis of the kidney. The patient was much freer from pain than in cases in which the kidney was closed without drainage. The patient is now going about and feels perfectly well. His urine is still loaded with pus, but he is free from pain. He has had no symptoms from the calculus in the left kidney since the operation. He will be watched closely and in a month or two when he has fully recovered from the last operation the calculus will be removed from the left kidney.

Case VI.—Intermittent attacks of renal colic on the left side for 3 years. Stricture of the lower end of the left ureter, impermeable to the catheter. Right ureter and kidney normal. Tubercle bacilli in urine. Nephro-ureterectomy.

This patient was a male, aged 35, who complained of pain in his left side and back. Three years ago he was taken with a severe pain in the left lumbar region which radiated into the bladder and to the glans penis. The pain was extremely severe and lasted about $\frac{1}{2}$ hour. After that he had similar attacks about twice a week, but never passed any blood or calculus. At times he had fever and night sweats; he suffered a great deal, but never lost any weight. When seen by me his urine contained a great deal of pus in which tubercle bacilli were present. There was no tenderness in the region of the left kidney or ureter.

The cystoscope showed a healthy bladder with the exception of the left ureteral orifice, which was obscured by several polypoid-like projections of mucous membrane which surrounded its orifice. The adjacent mucosa was considerably injected. The right ureteral orifice was normal, and a ureteral catheter was easily inserted and clear urine withdrawn. Attempts were made to catheterize the left ureter, but it was impossible to get the catheter to enter, probably owing to a stricture at the orifice. On October 1, an extraperitoneal nephro-ureterectomy was performed. At the time of operation tubercle bacilli had not been found in the urine, and no positive diagnosis had been made, and the ureter which was first exposed was found to be the size of a lead pencil, and its walls greatly thickened. Suspecting calculus of the lower end, the ureter was followed down to its vesical juncture, but no calculus was found. The kidney was then exposed and was found to be enlarged and lobulated and so definitely diseased that I decided to remove it without cutting into it for diagnosis. The kidney with the entire ureter down to about 1 inch of the bladder was removed in one piece. The muscular wound was closed with two places for drainage, and the patient made an uninterrupted recovery.

An examination of the specimen after removal showed miliary tuberculosis of the pelvis, several small portions of the cortex and the entire ureter. Another search was made for tubercle bacilli in the urine passed just before operation and they were found present. This case was particularly interesting on account of the fact that the history suggested calculus much more than tuberculosis.

Case VII.—Extensive pyonephrosis of left kidney of eight years' duration following typhoid fever. Typhoid bacillus present in pure culture. Catheterization of ureters. Right kidney healthy. Extraperitoneal nephrectomy. Cure.

This patient, male, aged 44, presented himself with a tremendous pus kidney upon the left side, which had begun after an attack of typhoid fever eight years previous. From his urine pure cultures of the typhoid bacillus were obtained.

As it is our intention to make an extensive report on this case elsewhere, I shall only show the specimen which was removed.

As you see from this specimen, the kidney and its pelvis were greatly dilated, forming a sac which contained about a quart of pus. The kidney was surrounded by a very dense capsule and about 1 inch thick. Imbedded in one portion of the cortex was one large calculus. The X-ray picture had failed to show this, probably owing, as in Case IV, to the very thick dense capsule which cast a shadow and obscured the calculi. It was impossible to remove this capsule owing to dense adhesions to the peritoneum and surrounding structures, and intracapsular enucleation was performed.

When the pedicle was reached a circumcision of the capsule at the hilus was performed, which gave an opportunity to isolate the vessels of the pedicle and ligate them before division. The abdominal wound was closed with small places for drainage, and the patient made an uninterrupted recovery. His urine is clear.

Dilated Ureter with Protrusion of Bladder Wall. Dr. Hunner.

Dr. Hunner reported briefly a case of dilated ureter causing a protrusion of the bladder wall. A full report will appear in the Bulletin.

Discussion.

Dr. Young.—Dr. Hunner's case is interesting. I have had only one similar. In this case during a cystoscopic examination a small rounded tumor was seen in the left half of the base of the bladder. Thinking that it was a neoplasm, I began to study it carefully, when it suddenly disappeared, much to my surprise. In a few seconds it again sprang into view and from its apex came a fine stream of urine, which continued to flow for several seconds, when the tumor again collapsed and remained so until the next peristaltic ejection of urine ballooned it. A suprapubic cystotomy showed that a tight stricture of the end of the ureter, with a small globular dilatation of the intramural portion of the tube was present.

I may say regarding the literature of these cases that these two cases of calculus which I have reported make the eighth and ninth cases of calculus of the lower end of the ureter in the male that have been operated on. Six cases have been operated upon abroad and three in this country, one by Dr. Finney, of stricture of the lower end of the ureter, and only three cases have been operated upon except by dilatation with bougies. One case was that of Meyer, who finding such a stricture, took out the kidney and ureter. The second case is that of Israel, who cut off the ureter and transplanted it into the vertex of the bladder. As far as I can find, my case is the only one operated on leaving the ureter *in situ*. The patient is in good condition and the orifice has not contracted. This procedure which I have called intravesical ureterotomy through the iliac extraperitoneal incision is not a difficult one, and is much preferable to transplantation of the ureter.

Dr. Hunner.—I would like to ask if any cultures were made in the case which had typhoid fever?

Dr. Young.—I did not go into that point because we intended to bring that out later, but cultures were obtained from the kidneys and from the urine. It seemed an unique case in that respect.

A Method of Sequestrating the Urinary Bladder in Extensive Operations Involving its Peritoneal Surfaces. Dr. Kelly.

Often in women and invariably in men the most convenient avenue of approach to the bladder for the purpose of doing extensive or delicate surgical operations involving the vesical walls, is by the suprapubic route through the lower abdominal wall.

If an incision is made from 10 to 12 cm. in length, between the recti muscles, and these muscles are then detached from their pubic insertions for a short distance on either

side, convenient access is afforded to the bladder which may then be extensively detached from its anterior and lateral pelvic attachments and even from its peritoneal covering, so as to afford the operator every facility for performing an extra-peritoneal operation.

When, however, there are areas of ulceration or old inflammatory disease producing a localized thickening of the bladder wall, involving especially the area covered by peritoneum, it is often impossible to effect a detachment of the peritoneum without tearing it, and any radical suprapubic operation, removing the diseased portion, must necessarily expose the patient to the risks of a general peritoneal infection from the organisms invariably present within the diseased bladder.

In a patient at present under my care upon whom I operated, November 20, I adopted for the first time a course which effectually obviated these great risks, and inasmuch as the plan pursued promises to be permissible in all similar cases of cystic affections both male and female, I feel that it is worth while to record the procedure in full.

The patient referred to had a cystitis of several years' standing, and when I first saw the bladder it was universally inflamed, being of an intense deep angry red color; one of the most prominent symptoms was excessive hemorrhage with every act of urination. After about two years' treatment by drainage, irrigations, topical applications through my open cystoscopes and curettage, the bladder became entirely normal in every part except a granular patch in the posterior hemisphere on the left side about 4 by 3 cm. in extent, traversing the bladder from vertex to base. For a time after a year of vigorous campaign against the disease, there was a complete cessation of all symptoms, and the patient returned home apparently in perfect health, but after a few months the hemorrhages began again, and when she returned to me I determined at once upon a radical excision of the affected area which my treatments had failed to cure. The procedure adopted was the following: After making an incision through the abdominal muscles from the symphysis upward about 10 cm. in length, I tried to detach the peritoneum for about 6 or 8 cm. on either side, but in doing this it was torn and the abdominal cavity opened. Being unable to make the operation extra-peritoneal I took steps to sequestrate the bladder; there is a natural peritoneal pocket forming a clearly defined fossa between the uterine body in its normal anteposition and the symphysis pubis, and this area was utilized for the purpose of sequestration of the bladder by suturing the uterine cornua and the free margins of each round ligament to the parietal peritoneum of the anterior abdominal wall; and in the median line, where in this case peritoneum was not available, the omentum was utilized by suturing its free edge to the fundus of the uterus. Fig. 1.

After loosely packing the artificial pocket thus created with gauze, the empty bladder was opened at its vertex, the disease area located and a long wedge of tissue about 7 cm. in length and from 2 to 3 cm. in breadth was exsected including in its upper half the entire thickness of the hypertrophied vesical wall. The wound thus made traversed the entire peritoneal surface of the bladder, and extended on the inside well down to the *bas fond*. The incision was closed with cumol catgut sutures throughout; in the lower portion

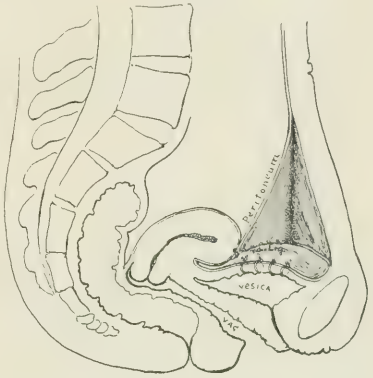


Fig. 1.—Shows peritoneum detached from the abdominal wall and sutured to the round ligament; a much lower detachment will often suffice. The bladder is represented sutured after an operation through its serous surface. The space between the peritoneum and the anterior face of the uterus above and the bladder below is the sequestrated area

passed and tied on the mucous surface of the bladder, in the upper part entering and emerging and tied on the peritoneal surface. Fig. 2. This new ante-uterine cavity formed by the suturing off of the peritoneum was finally loosely filled with a



Fig. 2.—Shows the peritoneum detached and sutured transversely across the pelvis to uterus and both round ligaments. As a rule the detachment need only extend about half as high as shown in the figure

washed-out iodoform gauze pack brought out as a drain at the lower angle of the abdominal wound, which was next closed down to this point. Two weeks have elapsed since the operation, the pocket is obliterated and the patient has suffered

no pain and there has not been the slightest sign of peritoneal infection and her previous repeated febrile attacks have completely disappeared together with the hemorrhages. I feel sure as I have claimed at the outset that the principle of sequestration thus successfully applied, in this instance, is a valuable procedure and one which is applicable in the vesical surgery of both sexes. In a deliberate procedure the peritoneum should be detached only a short distance above the symphysis and then for some 6 or 8 cm. on either side of the lower part of the abdominal wound; after effecting this de-



FIG. 3.—Shows the omentum attached below the bladder in the male pelvis and a drain introduced into the new formed retro-vesical space. The bladder is represented as pictured after an operation.

tachment it should then be incised transversely and as near the bladder as possible; the apron of peritoneum thus formed may then be successfuly stitched across the front of the uterus and to the margins of the round ligaments in women, or in the male, to the base of the bladder or even across the front of the rectum.

When the peritoneum cannot be detached in this way, and when it proves too friable for satisfactory suturing, the omentum may be used to take its place, either by simply suturing the free omental border transversely across the pelvis, and so forming a pre-omental peritoneal space which will probably be sufficient to limit an infection, or by attaching the omentum first by its free border in the manner just indicated and then again stitching it as well across the anterior abdominal wall at a point about 10 or 12 cm. from its free border, in this way decidedly limiting the pre-omental cavity to be drained. In suturing the omentum its vessels should be avoided. (Fig. 3.) I believe catgut sutures will last long enough to promote the necessary adhesions and to sequestrate the newly constructed retrovesical peritoneal pocket; there can, however, be no objection to the use of very fine silk for this purpose.

If the omentum is short and the parietal peritoneum cannot be used I would then proceed by suturing the round ligaments and afterwards the uterine body to the anterior abdominal wall.

If the pelvis is well packed with gauze the vesical operation could be performed first and the sequestration procedure at the close of the operation.

DISCUSSION.

DR. HUNNER.—I assisted Dr. Kelly with the case reported and the sequestration was very effective.

I think, however, that objection might be urged against the suggested fixation of the omentum, as I am about to report two cases in which omental adhesions to old operation wounds caused serious symptoms simulating gall-stone colic. This sequestration operation in women must necessarily be limited to those who will not again become pregnant because of the firm adhesions that must result from the fixation of the uterus and round ligaments.

Gonococcal Suppurative Myositis. DR. HARRIS and MR. HASKELL.

To appear later.

DISCUSSION.

DR. RANDOLPH.—I have been much interested in the communication of Dr. Harris. The cases which have been under discussion are those in which the metastases followed gonorrhœa of the genitals but there are at least three cases recorded in which metastatic inflammation resulted, when the primary lesion was in the eye, in other words after ophthalmia neonatorum. The most recent case is one reported by Paulsen. The child developed blennorrhœa of the conjunctiva on the third day. The disease ran a perfectly uneventful course and yielded well to treatment. On the eleventh day the left knee became swollen and that was followed by a swelling of the right knee. A considerable quantity of exudate was aspirated from the knee and a pure culture of the gonococcus was revealed. Those who are engaged in the lying-in service, especially outside of the hospital, might bear this possibility in mind when they meet with cases of ophthalmia neonatorum and examine the joints for conditions described by Paulsen and others. It is evident that a slight involvement of the joint could occur and not attract any attention.

I presume you all know that there is a form of iritis known as "gonorrhœal iritis" and it is supposed that this form of inflammation is due to the presence within the eyeball of the toxins of the gonococcus; certainly not to the presence of the organisms themselves, for when these organisms have once entered the eye destructive panophthalmitis ensues and we all know the intensity of the reaction, when the conjunctiva is attacked. While gonorrhœal iritis is sometimes stubborn its clinical picture does not suggest the presence of the gonococcus itself.

DR. HARRIS.—I think Wasselmann did not mean us to understand that the toxins were a soluble or circulating

toxine but derived from broken down organisms elsewhere. As soon as death occurs the cell breaks down and thus sets free its intracellular poison.

Syphilis of Peripheral Nerves. Mr. Remsen.

To appear later.

Discussion.

Dr. MacCallum.—There are several elements of interest in this case. The man had been vaccinated and dates his whole trouble from that time, but whether or not the infection actually occurred then, we cannot definitely decide. The lesion in the lung resembles so closely that in the arm that they have been regarded as part of the same process but of course when such large caseous masses are found in the lung, the question as to whether we are dealing with a syphilitic or a tuberculous process always arises. In this case unfortunately inoculation experiments were not carried out at the time of the autopsy, but from the fact that there are no typical tuberculous lesions in any other organs, even in the bronchial lymph glands, it seems probable that the affection may be of some different nature. No typical tubercles are found in this lung either, but simply large caseous masses, surrounded by fibrous tissue, and patient search has failed to reveal any tubercle bacilli, so that it seems justifiable to regard these caseous masses as gummata.

INSTRUCTION IN PSYCHIATRY AND NEURO-PATHOLOGY.

A limited number of graduates in medicine can have an opportunity for work in the laboratory of the Sheppard and Enoch Pratt Hospital.

Instruction in neuro-pathology will be given by the director of the laboratory, and those attending the course will be permitted to attend the clinical and other conferences of the medical staff. Clinical forms of insanity will be discussed, as well as the hospital and home care of the insane.

Physicians taking this course will also have an opportunity to attend the neurological clinics at the Johns Hopkins Hospital.

For particulars, apply by letter to Dr. E. N. Brush, Physician-in-Chief and Superintendent, Sheppard and Enoch Pratt Hospital, Station "A," Baltimore.

NOTES ON NEW BOOKS.

The Thirty-third Annual Report of the State Board of Health of Massachusetts. (*Boston: Wright & Potter, 1902.*)

This report shows the work of the Board for the year ending September 30, 1901, except that the records relating to water supply and sewerage are for the calendar year 1901.

The general death rate of the State for this year was the lowest recorded to date, 16.82 per 1000, the next lowest being 17 per 1000 in 1867, and the next 17.33 in 1859. Although hygienic improvement must receive a due share of credit, immigration is a factor also, 67.8 per cent of immigrants being between 15 and 40 years of age and only about 10.2 per cent over 40. As these persons grow older, the death rate may be expected to rise.

As compared with 1900, a general decrease in deaths from infectious diseases occurred. Of eleven infectious diseases, two, smallpox and cholera infantum, showed an increase aggregating 406, the remainder showing decreases aggregating 1401.

Smallpox.—In 1899, 105 *cases* were reported; in 1900, 104 *cases*, and in 1901, 778 cases and 97 *deaths*. During the latter year, the *cases* reported rose from about 6 per month during the first third of the year to 274 cases in December. Of these cases 407 had not been vaccinated at all, 251 (adults) had been vaccinated only in infancy, and the facts concerning 13 were unknown, leaving 107 vaccinated who contracted the disease after vaccination during adult life. Those of this class who yet contracted the disease, formed, roughly speaking, one-seventh of the whole number attacked. Of the total cases, more than one-half had not been vaccinated at all. It is well known that the greater part of the population has been vaccinated at some time or other, so that the much smaller unvaccinated portion supplied more than one-half the total number attacked. Another striking fact is that in the period 1888-1901, only 65 vaccinated persons under 15 years of age (i. e., cases where the vaccination could not have been more than 15 years old), were attacked, with *no* deaths, while during the same period, five times as many unvaccinated of the same age were attacked and more than 10 per cent of these died. The type of smallpox during this period was mild.

State Production of Vaccine Lymph.—Many considerations detailed in this report and elsewhere induced the Massachusetts State Board, certainly one of the first in this country in general standing, efficiency and reputation, to direct its efforts towards securing a State-directed vaccine laboratory. Ably seconded though this movement has been by the health authorities of the principal city of the State, by the Associated Boards of Health of the State and by the medical profession generally, this perfectly logical and reasonable proposition was rejected by the legislature owing largely to the influence of persons concerned in the commercial production of vaccine and to retail druggists. So far was this opposition carried that the making of diphtheria antitoxin by the State, under the high authority of Dr. Theobald Smith, is also now (1902) threatened with suspension after a most successful period of life-saving effort extending over eight years.

Diphtheria.—The case rate and death rate diminished considerably as compared with the previous year. This disease is subject to cyclical fluctuations and the records for 1902 point to an even greater diminution than those of 1901.

Typhoid Fever.—Shows the smallest number of deaths in any year since the beginning of registration in 1842.

Consumption.—In 1872, 5556 persons died from this disease. In 1901, with the population nearly doubled, the deaths had actually decreased, being 5033 in the latter year.

New Legislation.—Of the new acts relating to Public Health, the following are of interest:

1. Transferring the inspection and assay of liquors to the State Board of Health.

2. Requiring *personal examination* of the patient before a certificate of unfitness for vaccination is given.

3. Empowering the Board to publish monthly, in its own publication or in the public press, the names, etc., of firms whose products on analysis shall have been found adulterated.

4. Directing the Board, and also the Massachusetts Agricultural College, to investigate vaccine manufacture and report on a plan for State production.

The act requiring a personal examination of a child before giving a certificate of unfitness for vaccination became necessary

because unscrupulous physicians often filled in and gave such certificates without having seen the person purporting to require the certificate. The present act could itself be improved by requiring that a definite departure from normal health must exist and be certified to in terms before such a certificate receives standing. This because certain physicians maintain that the physical condition of everyone is such that vaccination will be harmful. Still better would it be to designate a special medical officer or the local Board of Health to pass upon the fitness of such children. Ample precedent for such action could be found in the appointment of medical examiners, coroners, etc.

Lawrence Experimental Station.—A special study of the effluents of filters of coarse materials was conducted by Mr. H. W. Clark, chemist of the Board, under the general supervision of Hiram F. Mills, M. A., C. E., a member of the Board. As compared with sand filters, the effluents of these coarse materials filters are rather uniformly turbid and poor in appearance, yet the effluents are high in nitrates and do not readily putrefy, in contrast with those turbid effluents sometimes yielded by sand filters under unfavorable conditions. The matters in suspension passing through a coarse filter on the "intermittent continuous" system are affected without being liquefied or removed, so that they are no longer highly putrescible. The sludge from ordinary sewage is still highly putrescible, but the sludge from the turbid effluent of a coarse filter more nearly resembles the humus of ordinary loam. Various details are given, with full descriptions of various experiments on this and cognate subjects. Mr. Clark also reports on the experiments relating to the Springfield water supply.

Mr. Gage contributes a paper on bacteriological studies with special reference to B. coli, and on species differentiation, with a proposed classification of bacteria, which, as Mr. Gage states, was suggested by Arthur I. Kendall. Mr. Kendall and Mr. Gage have carried out Mr. Kendall's outline in practice, independently of each other, arriving at very closely similar results. Both have presented the results in public. When publication permits detailed comparison, it will be interesting to determine exactly what the differences may be.

Food and Drug Inspection.—Very instructive and interesting results are given, together with valuable descriptions of test methods. Amongst the latter are quick methods for detecting preservatives in milk, detection of oleomargarine, identification of foreign coloring matter in butter, tests for flavoring extracts, tests for glucose in honey, etc. An interesting fact is that the percentage of adulteration of samples of capsicum bought from druggists was greater than the percentage of adulterated samples obtained from grocers. As pointed out in previous reports, the higher prices of the drug store sometimes induces an unfounded confidence in the superiority of their wares.

Antitoxin.—The report of Dr. Theobald Smith, always interesting, demands greater attention because of the threatened suspension of the work due to commercial influences as already outlined. A number of letters are quoted, received from various local authorities in the cities and towns of the State and showing that but for the free distribution of the State antitoxin, many diphtheria cases would have been denied the advantages of this treatment, varying from 25 per cent to 75 per cent, and even 90 per cent of the cases in different localities.

The advantage of early administration is particularly emphasized. A summary for seven years shows an average fatality of 10.4 per cent in the 12,730 cases treated. Of 4181 cases treated within the first forty-eight hours, 6.6 per cent died, while of the remainder, the death rate rises with increased delay, so that of those treated on the sixth day or later, 17.8 per cent died, nearly three times as great a proportion. Although not so suggested in the report, these figures furnish a potent argument for free antitoxin, since a poor man, not fully understanding the danger of delay, will often hesitate to involve himself in expenses which when later developments force him to assume them, may then prove unavailing. With free antitoxin, delay on this account need never occur.

Under Health of Towns, Medical Inspector Morse records the results of investigations made of epidemics in various parts of the State. In Adams, he traced typhoid to milk; in Salem and Beverly, scarlet fever seems to have similarly originated. A table of examinations for smallpox is also given.

HIBBERT WINSLOW HILL.

A System of Physiological Therapeutics. Edited by Solomon Solis Cohen, A. M., M. D. Vol. IX. Hydrotherapy, Thermotherapy, Phototherapy, Mineral Waters, Baths. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

Part I of the present volume, written by Dr. Wilhelm Winternitz, deals fully with the physiologic basis of the therapeutic uses of water and light. The whole subject is viewed from a broad standpoint and is handled in a most interesting way, these chapters thus forming a fitting introduction to the more practical portion of the work. In Part II the technic and various methods of hydrotherapy are described by Dr. Alois Strasser, while Part III, by Dr. E. Bruxbaum, indicates with precision the various procedures which are applicable to different forms of disease. Supplementary chapters on Heliotherapy, Phototherapy and Thermotherapy are contributed by Dr. J. H. Kellogg, while the subject of saline infusions and irrigations, by Dr. Harvey Cushing, forms an interesting and instructive chapter.

Balneology and Crounotherapy (drinking-cures) are dealt with by Dr. E. Heinrich Kisch, notes on American Springs being contributed by Dr. Guy Hinsdale. This part of the work is prefaced by a classification of mineral waters, with especial reference to those of the United States, by Albert C. Peale.

The authors are especially to be congratulated upon the fact that they have not hesitated to go into detail and have supplied the book with figures illustrating not only the more elaborate but also the simplest procedures. Had the medical profession not allowed Pindar's aphorism, "Water is the best thing of all," to be forgotten; had an intelligent system of hydrotherapy been gradually evolved from his time, and great fundamental truths not have been allowed to become obscured by a thousand "ologies" and polypharmacy, we should have been spared the trouble of rediscovering a lost art and rescuing it from amid a mass of charlatanry and superstition.

To a large extent the present volume will be useful mainly as a reference book, but its practical tone cannot fail to recommend it to the general practitioner. Water, internally and externally, light, fresh air, heat and cold, even without expensive and elaborate appliances, can be made to subserve many therapeutic uses, and the work, while containing some things that smack a little of the enthusiasm of the specialist, and recommending not a few procedures that are beyond the reach of the men who cannot command a sanatorium or a hospital, supplies many very valuable hints whereby a rational adaptation of these valuable agents amid more humble surroundings is rendered easier, so that their field of usefulness can be much more widely extended than would at first sight have appeared possible.

Manual of Gynecology. By Henry T. Byford, Professor of Gynecology in the College of Physicians and Surgeons of Chicago. Third revised edition. 598 pages. 363 illustrations. (*Philadelphia: P. Blakiston's Son & Co.*)

To the new edition of this manual the author has added considerable new matter and has rearranged several of the chapters. It is a concise and practical work for the student and general practitioner, neither so voluminous as the more extensive works on the subject, nor so puerile as the average quiz compend. It is comprehensive and its teachings can be safely followed.

The illustrations, with the exception of the reproduced photographs of pathological specimens, are clear and well chosen. The press work is excellent.

Die Röntgenstrahlen im Dienste der Chirurgie. By Dr. Carl Beck. (*München: Verlagsbuchhandlung, Seitz & Schauer.*)

The work consists of two parts. Part I, of 138 pages, deals with the technique and general principles of the production of the X-ray, its value to surgery and its therapeutic worth.

After a brief introduction, Dr. Beck devotes a section to equipment. In common with most radiographers, he advises a coil with a sparking distance of not less than 40 cm., in conjunction with an electrolytic or mercury interruptor. He justly, however, considers the tube the most important factor in the equipment, and shows that only by good judgment in its selection can one produce good radiographs. In taking a radiograph he advises placing the tube only 12 cm. from the patient. This is contrary to the general opinion, as by so doing both clearness and definition are lost, and the danger of burning the patient is increased.

The subject matter is dealt with in sections corresponding to the anatomical divisions, as head, thorax, abdomen and extremities. The various lesions of these parts are illustrated by the plates in Part II. In the discussion of the radiograph he emphasizes the importance of a proper interpretation of the negative.

In the section devoted to the abdomen considerable attention is paid to the different forms of biliary, renal and vesical calculi. His results, especially in the cases of biliary calculi, are apparently far superior to those obtained by other radiographers. He even goes so far as to differentiate between the various forms of stones.

The last section is devoted to burns and the therapeutics of the X-ray. He recognizes three degrees of burns, the first being the stage of erythema; the second, that of the formation of vesicles, and the third, that of ulcers and sloughs. The fundamental principle in his theory is that the formation of toxic substances in the tissues, following X-ray exposure, plays an important part in the production of burns.

In the treatment of malignant growths he finds that the epitheliomata respond the most readily to treatment. The knife, however, should be used first and then the X-rays employed to prevent a recurrence.

Part II is made up of 65 plates illustrating the cases in Part I, and various other interesting lesions. The plates, which are half-tones, are for the most part poor. The exceptions are those of biliary and vesical calculi, which come out with such startling clearness as to suggest a retouching of the negatives.

The arrangement of the sections is bad, and the book not being indexed, is practically useless for reference purposes. The plates in Part II are such poor reproductions as hardly to be worth looking over. The author appears to go beyond the province of the book when he discusses surgical methods and procedures in the various cases. Although the book is well written, it adds little to our knowledge nor is it of value to the beginner, for the reason that it does not go sufficiently into details.

American Edition of Nothnagel's Practice. Diseases of the Bronchi and Pleura; Pneumonia. By various authors and edited by John H. Musser, M. D., of Philadelphia. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The volumes of a system of medicine should not be expected to be of equal merit. One watches with interest the varying styles of the different articles. In reviewing this volume these differences are specially brought to mind, and one rather suspects that to Dr. Musser has fallen a heavier task than to some of his fellow editors of the American edition. Perspicuity is a virtue sometimes lacking in our German friends—not that this is confined to them—and parts of this volume may be quoted as examples. The translator has not always been very happy in his part. Doubtless the original is often involved and the sentences complicated, but these should be all the more reasons for clear English. Many of the sentences are on first reading quite obscure. Dr. Musser is to be congratulated on his part. Throughout the book his additions and notes are timely and well put. They are in places the best part of the section.

The book opens with the diseases of the bronchi, by Dr. Hoffmann, of Leipsic. The anatomy of the bronchi is first taken up. Then follows a lengthy section on foreign bodies in the bronchi. Bronchitis is discussed at some length, the author giving fifteen varieties. His discussion of the whole subject cannot be called illuminating. There are occasional flashes of light worthy of note; for example, he says of capillary bronchitis that "In truth next to nothing has been proved concerning it." The treatment advised for bronchitis is first, hydrotherapy in the form of compresses, affusions, packs, and in some cases cold douches or hot baths; and second, inhalations and respiratory gymnastics with local applications in some cases. The usual treatment by drugs he considers as pure empiricism. His points against blind polypharmacy are well taken. Under Fibrinous Bronchitis we are glad to see that Dr. Musser has referred very fully to Bettmann's work on the subject. The cases of bronchiectasis are divided into four groups, of which only two are important; these are the inflammatory, which is usually called saccular, and the vicarious, usually termed cylindric. The main etiological factor in the former he considers to be stenosis and a continuous excess of pressure. In the treatment the editor draws attention to two important points, namely, the postural method by raising the foot of the bed and so favoring drainage, and the use of inhalations of creosote vapor. The articles on asthma and emphysema are also contributed by Dr. Hoffmann.

Dr. Aufrecht, of Magdeburg, writes on Inflammations of the Lungs. It is not possible to review this in detail. We may look at the section on the treatment of pneumonia, following the practice of an old reviewer, who said that he always based his opinion of a text-book of medicine on the section dealing with the treatment of pneumonia. Dr. Aufrecht's treatment may be briefly given as morphia if necessary for the pain or cough and an ice bag to the affected side. If the patient has had previous cardiac trouble, digitalis is advised, but these cases he considers rare. Otherwise he gives quinine and iron. He advises distinctly against the use of stimulants unless in collapse. In cases with more marked symptoms and toxæmia a hypodermic injection of 7½ grains of quinine hydrochlorate is advised. This may be repeated. For delirium chloral is advised. We should consider his treatment as quite suitable in mild cases, but for severe ones it seems rather inadequate.

Diseases of the pleura are taken up by Dr. Rosenbäch, of Berlin. These articles are in many ways good, but to one who has not already his knowledge of these subjects well arranged they are likely to be rather confusing. There is much theoretical discussion. One misses a good description of thickened pleura.

This book will be useful for reference and to those who have some knowledge of the subjects discussed. But to a student or to one who seeks a clear, definite idea of the subjects treated it is likely to prove very disappointing.

Atlas and Epitome of Traumatic Fractures and Dislocations. By Professor Dr. H. Helferich, Professor of Surgery at the Royal University, Greifswald, Prussia. Edited, with additions, by Joseph C. Bloodgood, M. D., Associate in Surgery, Johns Hopkins University, Baltimore. From the fifth revised and enlarged German edition. With 216 colored illustrations on 64 lithographic plates, 190 text-cuts, and 353 pages of text. (*Philadelphia and London: W. B. Saunders & Co., 1902.*) Cloth, $3.00 net.

The Treatment of Fractures. By Chas. L. Scudder, M. D., Assistant in Clinical and Operative Surgery, Harvard Medical School. Third edition, revised and enlarged. Octavo, 480 pages, with 645 original illustrations. (*Philadelphia and London: W. B. Saunders & Co., 1902.*) Polished buckram, $4.50 net; half morocco, $5.50 net.

The authors of both the above books declare their intention of providing a manual which shall serve as a practical guide for the surgeon. Dr. Helferich, welcoming "the opportunity to use the specimens and drawings collected in the course of years," has produced a book whose colored plates convey to the eye perfect pictures of the anatomical conditions present in fractures; while Dr. Scudder's one aim is to help the student determine "how to meet the conditions found in each individual case of fracture." To illustrate the different methods of approaching the subject, compare the sections on fracture of the neck of the humerus, or of the femur, in the two books. Dr. Helferich's anatomical and pathological plates, prepared from his own complete collection, are certainly more vivid than the sketches in Dr. Scudder's book; on the other hand, the methods of recognizing the nature of the injury, and above all, the explicit directions for treatment (whose simplicity commends itself to the American surgeon), receive far more attention in the latter. The sections on the after-care of the patient are also more satisfactory in Dr. Scudder's book.

The plates illustrating Kocher's method of reducing subcoracoid dislocations of the humerus, as well as the plates showing the anatomical conditions in dislocations of the hip, are especially noteworthy in Dr. Helferich's book. One heartily endorses the note of the American editor in which he criticises the cumbersomeness of many of the dressings. Dr. Bloodgood's remarks have added not a little to the value of the book.

In Dr. Scudder's book, the addition of clear photographs of the normal scapula and of fractures of the vertebræ, as well as of the chapter on gunshot wounds of bone, have made the new edition more indispensable than ever.

It is scarcely necessary to add that, for the American surgeon, Dr. Scudder's is by far the more important and useful book.

Diseases of the Stomach. By John C. Hemmeter, M. D. Third edition. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

The appearance of the third edition is a good proof of the popularity of this work. When the previous editions have been noticed there is little additional to be said of the third. One of the valuable features of the work is the bibliography, and this Dr. Hemmeter has brought up to date. As the author says, succeeding editions of a text-book largely reflect the general activity of work in its special domain.

A Treatise on the Diseases of the Eye, Nose, Throat and Ear. For Students and Practitioners. By Various Authors. Edited by William Campbell Posey, A. B., M. D., Professor of Ophthalmology in the Philadelphia Polyclinic; Surgeon to the Wills Eye Hospital; Ophthalmic Surgeon to the Howard and Epileptic Hospitals; Member of the American Ophthalmological Society; and Jonathan Wright, M. D., Attending Laryngologist to the Kings County Hospital; Laryngologist to the Brooklyn Eye and Ear Hospital; Surgeon to the Manhattan Eye and Ear Hospital Throat Department; Pathologist to the Manhattan Eye and Ear Hospital. Illustrated with 650 engravings and 35 plates in colors and monochrome. (*Philadelphia and New York: Lea Brothers & Co., 1903.*)

This system is similar to "An American Text-book of Diseases of the Eye, Ear, Nose and Throat," not only in its general features but also in the fact that ten of its contributors are to be found in the list of those who wrote for the latter work. The work of Posey and Wright is undoubtedly a valuable and practical collection of knowledge, as one would infer from a glance at the names of those who have taken part in its production—27 in all: Examination of the Eye, by William Campbell Posey, M. D. The Physiology of Vision, by William Norwood Suter, M. D. Refractive Errors in General, by Alexander Duane, M. D. The Motions of the Eyeball and Their Derangements, by Casey A. Wood, M. D. Diseases of the Orbit, Lachrymal Apparatus and Lids, by R. A. Reeve, M. D. Diseases of the Conjunctiva, Cornea, and Sclera, by John E. Weeks, M. D. Embryology of the Eye: Anomalies, Diseases, and Injuries of the Iris, Ciliary Body, Choroid, and Vitreous, by H. V. Würdemann, M. D. Sympathetic Ophthalmia, by H. Gifford, M. D. Diseases of the Retina, Optic Nerve, and its Cerebral Origin, by T. Holmes Spicer, F. R. C. S. Eng. Diseases of the Crystalline Lens, by Edward C. Ellett, M. D. Glaucoma, by E. Treacher Collins, F. R. C. S. Eng. Disturbances of Vision without Apparent Lesion, by Elmer G. Starr, M. D. The Eye in Its Relation to General Diseases, by C. F. Clark, M. D. General Preparation for Operations on the Eye, by Clarence A. Veasey, A. M., M. D. The Technique of the Pathological and Bacteriological Examinations of the Eye, by Edward A. Shumway, B. S., M. D.

The Histological Pathology of Diseases of the Nose and Throat, by J. L. Goodale, M. D. Methods of Examination; Instruments and Apparatus and Their Use, by J. E. Newcomb, M. D. Inflammatory Diseases of the Upper Air Passages; Hay Fever; Rhinorrhea; Asthma; Influenza, by Charles W. Richardson, M. D. Diphtheria of Nose and Throat; Intubation; Syphilis, Tuberculosis, Lupus and Leprosy of Nose and Throat; Chronic Laryngeal Stenosis; Foreign Bodies in Nose and Throat; Rhinoliths, by William Kelly Simpson, M. D. Neoplasms of the Nose and Larynx; The Local, Medicinal, and Surgical Treatment of the Larynx, by W. E. Casselberry, M. D. Diseases of the Accessory Sinuses, by St. Clair Thompson, M. D., F. R. C. S. Eng. Diseases of the Oropharynx and Nasopharynx, by H. S. Birkett, M. D. Neuroses of the Nose and Throat, by Emil Mayer, M. D. External Deformities of the Nose; Cleft Palate, by F. E. Hopkins, M. D.

Examination of the Ear; Diseases of the External Ear; Diseases of the External Auditory Meatus; Otomycosis; Foreign Bodies; Wounds of the Membrana Tympani, by F. E. Hopkins, M. D. Diseases of the Internal Ear and Auditory Nerve; Deaf Mutism, by E. A. Crockett, M. D. Purulent Inflammation of the Middle Ear, by Henry Arnold Alderton, M. D. Chronic Non-Suppurative Middle-Ear Disease, by Arthur H. Cheatle, F. R. C. S. Eng.

So far as simple perusal goes, a single style, the product of one individual, would be more pleasing, but in this event the authority which is found in a multitude of counselors would be absent. It is evident, however, that a detailed review of such a work would be tiresome, and we think in this case it would be unnecessary, for while there are some things which call for adverse criticism, on the whole the book is a distinct success, and we are confident that it will fulfil the aims of its editors and win popularity among students and practitioners. Attention must be called to indications of carelessness, as for instance on page 304 a disastrous attempt is made to give the name of the investigator of Oyster Shuckers' Keratitis. Again, on page 590, Königstein, the well-known Vienna ophthalmologist, might find fault with the appearance of his name. On page 593 the name of Cheatham, of Louisville, is misspelled. In a work of this character these things are inexcusable. It is well printed on good paper, and the illustrations for the most part are all that could be desired.

BOOKS RECEIVED.

A Nurse's Guide for the Operating Room. By Nicholas Senn, M. D., Ph. D., LL. D., C. M. 1902. 8vo. 131 pages. W. T. Keener & Co., Chicago, Ill.

A Manual of Medical Treatment or Clinical Therapeutics. By I. Burney Yeo, M. D., F. R. C. P. Tenth Edition. Two volumes. 1902. 12mo. W. T. Keener & Co., Chicago.

Clinical Methods. A Guide to the Practical Study of Medicine. By Robert Hutchison, M. D., M. R. C. P., and Harry Rainy, M. A., F. R. C. P. Ed., F. R. S. C. Fifth edition. With upwards of 150 illustrations and 8 colored plates. 1902. 16mo. 612 pages. W. T. Keener & Co., Chicago.

Manual of Gynecology. By Henry T. Byford, M. D. Third revised edition. Containing 363 illustrations, many of which are original. 1902. 8vo. 598 pages. P. Blakiston's Son & Co., Philadelphia.

A Text-Book of Pathology and Pathological Anatomy. By Dr. Hans Schmaus. Translated from the sixth German edition by A. E. Thayer, M. D. Edited with additions by James Ewing, M. D. Illustrated with 351 engravings, including 35 colored inset plates. 1902. 8vo. 602 pages. Lea Bros. & Co., Philadelphia and New York.

A Text-Book of Anatomy. By American Authors. Edited by Frederic Henry Gerrish, M. D. Second edition, revised and enlarged. Illustrated with 1003 engravings in black and colors. 1902. 4to. 944 pages. Lea Bros. & Co., Philadelphia and New York.

Transactions of the State Medical Association of Texas. Thirty-fourth annual session held at Dallas, Texas, May 6, 7, 8 and 9, 1902. 8vo. 587 pages. Austin, Texas.

A Handbook of Materia Medica, Pharmacy and Therapeutics. Including the Physiological Action of Drugs, the Special Therapeutics of Disease, Official and Practical Pharmacy, and Minute Directions for Prescription Writing. By Samuel O. L. Potter, A. M., M. D., M. R. C. P. Lond. Ninth edition, revised and enlarged. 1902. 8vo. 951 pages. P. Blakiston's Son & Co., Philadelphia.

Transactions of the State Medical Society of Wisconsin. Volume XXXVI. For the year 1902. Constitution and By-Laws and List of Members. 8vo. 474 pages. Madison, Wis.

Transactions of the Association of American Physicians. Seventeenth session held at Washington, D. C., April 29 and 30, 1902. Volume XVII. 8vo. 667 pages. Printed for the Association, Philadelphia.

Text-Book of Medical Jurisprudence and Toxicology. By John J. Reese, M. D. Sixth edition revised by Henry Leffmann, A. M., M. D. 1902. 8vo. 660 pages. P. Blakiston's Son & Co., Philadelphia.

The Development of the Human Body. A Manual of Human Embryology. By J. Playfair McMurrich, A. M., Ph. D. With 270 illustrations. 1902. 8vo. 527 pages. P. Blakiston's Son & Co., Philadelphia.

A Treatise on Diseases of the Eye, Nose, Throat and Ear. For Students and Practitioners. By Various Authors. Edited by William Campbell Posey, A. B., M. D., and Jonathan Wright, M. D. Illustrated with 650 engravings and 35 plates in colors and monochrome. 1903. 8vo. 1238 pages. Lea Bros. & Co., Philadelphia and New York.

The Story of a Living Temple. A Study of the Human Body. By Frederick M. Rossiter, B. S., M. D., and Mary Henry Rossiter, A. M. 1902. 12mo. 348 pages. Fleming H. Revell Company, Chicago, New York, Toronto.

Diseases of the Pancreas and Their Surgical Treatment. By A. W. Mayo Robson, F. R. C. S., and B. G. A. Moynihan, M. S. (Lond.), F. R. C. S. Illustrated. 1903. 8vo. 293 pages. W. B. Saunders & Co., Philadelphia and London.

Medical Microscopy. Designed for Students in Laboratory Work and for Practitioners. By T. E. Oertel, M. D. With 131 illustrations, some of which are colored. 1902. 8vo. 362 pages. P. Blakiston's Son & Co., Philadelphia.

The Elements of Bacteriological Technique. A Laboratory Guide for the Medical, Dental and Technical Student. By J. W. H. Eyre, M. D., M. S., F. R. S. Edin. With 170 illustrations. 371 pages. 1902. 8vo. W. B. Saunders & Co., Philadelphia and London.

Lessons and Laboratory Exercises in Bacteriology. An Outline of Technical Methods Introductory to the Systematic Study and Identification of Bacteria. Arranged for the use of students. By Allen J. Smith, M. D. 1902. 8vo. 298 pages. P. Blakiston's Son & Co., Philadelphia.

American Edition of Nothnagel's Practice. Diseases of the Bronchi, Lungs and Pleura. By Prof. Dr. Friedrich A. Hoffmann, Prof. Dr. O. Rosenbach, Dr. E. Aufrecht. Edited, with additions, by John H. Musser, M. D. Authorized translation from the German, under the editorial supervision of Alfred Stengel, M. D. 1902. 8vo. 1029 pages. W. B. Saunders & Co., Philadelphia and London.

The American Text-Book of Obstetrics. For Practitioners and Students. By James C. Cameron, M. D., *et al.* Richard C. Norris, M. D., Editor. Robert L. Dickinson, M. D., Art Editor. With nearly 900 illustrations. Second edition, revised. Two volumes. 1902. 4to. W. B. Saunders & Co., Philadelphia and London.

Twenty-third Annual Report of the State Board of Health of Massachusetts. 1901. 8vo. xlvii + 615 pages. 1902. Wright & Potter Printing Co., Boston.

Diseases of the Eye. A Handbook of Ophthalmic Practice for Students and Practitioners. By G. E. de Schweinitz, A. M., M. D. Fourth edition, thoroughly revised. With 280 illustrations and six chromo-lithographic plates. 1903. 8vo. 773 pages. W. B. Saunders & Co., Philadelphia and London.

Index Catalogue of the Library of the Surgeon General's Office, United States Army. Authors and Subjects. Second Series. Vol. VII. Hernia-Inquiry. 1902. 4to. 1003 pages. Government Printing Office, Washington.

Progressive Medicine. A Quarterly Digest of Advances, Discoveries and Improvements in the Medical and Surgical Sciences. Edited by Hobart Amory Hare, M. D., assisted by H. R. M. Landis, M. D. Volume IV. December, 1902. 8vo. 422 pages. 1902. Lea Bros. & Co., Philadelphia and New York.

Transactions of the American Surgical Association. Volume the Twentieth. Edited by Richard H. Harte, M. D. 8vo. 1902. xxviii + 571 pages. Printed for the Association, Philadelphia.

Transactions of the Twenty-fourth Annual Meeting of the American Laryngological Association, held at Boston, Mass., May 26, 27 and 28, 1902. 8vo. 259 pages. New York.

Transactions of the Medical Society of London. Volume the Twenty-fifth. Edited by Arthur Francis Voelcker, M. D., F. R. C. P., and Jonathan Hutchinson, Junr., F. R. C. S. 1902. 8vo. 368 pages. Printed for the Society, London.

Atlas and Epitome of Human Histology and Microscopic Anatomy. By Doctor Johannes Sobotta. Edited, with extensive additions, by G. Carl Huber, M. D. Authorized translation from the German. With 171 illustrations on 80 lithographic plates, and 68 text illustrations. 1903. 12mo. 248 pages. W. B. Saunders & Co., Philadelphia and London.

Atlas and Epitome of Diseases of the Mouth, Pharynx and Nose. By Dr. L. Grünwald, of Munich. Second edition, revised and enlarged. Authorized translation from the German. Edited, with additions, by James E. Newcomb, M. D. With 102 illustrations on 42 lithographic plates, and 41 figures in the text. 1903. 12mo. 219 pages. W. B. Saunders & Co., Philadelphia & London.

Book on the Physician Himself, and Things that Concern His Reputation and Success. By D. W. Cathell, M. D. The Twentieth Century Edition. Being the eleventh edition revised and enlarged by the author and his son, William T. Cathell, A. M., M. D. 1902. 8vo. 411 pages. F. A. Davis Company, Philadelphia.

Golden Rules of Refraction. By Ernest E. Maddox, M. D., F. R. C. S. "Golden Rules" Series. No. XII. 32mo. 86 pages. John Wright & Co., Bristol; Simpkin, Marshall, Hamilton, Kent & Co., Lim., London.

Surgical Anatomy and Operative Surgery. For Students and Practitioners. By John J. McGrath, M. D. With 227 illustrations, including colors and half-tones. 1902. 8vo. 559 pages. F. A. Davis Company, Philadelphia.

Transactions of the American Gynecological Society. Volume 27. For the year 1902. 8vo. 446 pages. Philadelphia.

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ON THE MECHANISM OF ABSORPTION OF GRANULAR MATERIALS FROM THE PERITONEUM.

By W. G. MacCallum,

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As is well known there has been for a long time a desultory discussion as to the manner in which various materials are absorbed from the peritoneum and even in the case of solutions, it does not yet seem quite clear whether they are absorbed exclusively by the lymphatics or very largely by the veins. In the explanation of the absorption of granular materials we have an even more complicated process, which indeed illustrates always, one may say, the adaptation of the organism to a pathological condition, for one really cannot speak of an absorption of granular material from the peritoneum under normal conditions. Even the presence of red blood corpuscles, or leucocytes, or desquamated epithelial cells in the peritoneal cavity is in reality an abnormal condition and their removal must be effected by some means which form part of the reserve resources of the organism in the restoration of the normal conditions. It would seem *a priori* improbable that a special structure of the peritoneal walls should be arranged for the accommodation of granules of a certain size which might gain access to the peritoneum.

The question of the absorption of fluids has been discussed recently by Hamburger,[1] Cohnstein,[2] Adler and Meltzer,[3] Schnitzler and Ewald,[4] Starling and Tubby,[5] Mendel,[6] and others, the problem being mainly the determination of the relative amounts absorbed through the lymphatics and through the veins.

This problem is of course of the most fundamental importance, first of all in its bearing on the relation in function between the lymphatic system in general and the veins. As has been frequently stated, and very clearly defined by

[1] Centralblatt für Physiologie, 1895, ix, 484.
[2] Centralblatt für Physiologie, 1895, ix, 401.
[3] Journal of Experimental Medicine, Vol. 1, Jour. Physiol. 1897-8, xxii.
[4] Zeitschrift für Chirurgie, 1895. Wien klin. Rundschau, 1895, s. 273.
[5] Journal of Physiology, 1897-8, xxii.
[6] American Journal of Physiology, Vol. ii, 1898, p. xvi.

Dr. Sabin in a recent paper, the function of the lymphatic system is largely in the presentation of a channel in which the pressure is that of the veins near the heart, a pressure well known to be lower than that in the peripheral veins and into which the fluids of the tissues, in which the pressure is probably somewhere between that in the veins and that in the lymphatics, may drain. Now if it be found that nevertheless the chief absorption of fluid is carried out by the veins, we have the lymphatics occupying somewhat of a sinecure. The question is practically identical with that of the distribution of fluid injected into the subcutaneous tissue of a limb, in which the solution of the problem would probably be easier than in the peritoneum where it has been especially studied.

As to the mechanism of the entrance of the fluid into any of these channels by direct filtration, under the laws of osmosis and mechanical pressure, there is no great difficulty. It is not, however, so simple to explain the method by which insoluble granules gain entrance into the lymphatics. That they do so with great rapidity has long been known, although the various observers have held directly opposite opinions as to the mechanism of this absorption. v. Recklinghausen,[7] after demonstrating that such absorption did take place, arranged a rabbit's diaphragm on the stage of the microscope and covered it with milk. In his paper he states that he could clearly see the globules of the milk running in a vortex into holes in the serous lining of the diaphragm, leading down into the underlying lymphatics. These holes he was able to find afterwards in the same preparation and succeeded in outlining them with silver. With such large stomata the idea of the absorption of granules is a simple enough matter. No one, as far as I know, has ever succeeded in repeating this experiment although every one quotes him, and very many conclusions are based upon the observation. I have myself performed the experiment repeatedly—always with quite negative results—the milk runs into the grooves left between the tendinous fibers by the collapse of the lymphatics, but on washing off the surface all of it is washed off.

Two ideas have been in general vogue, as is well known, concerning the openings in the peritoneum. On the one hand the so-called stomata are generally thought of as openings of considerable size, surrounded more or less regularly by a radial arrangement of cells which are often somewhat differentiated from their neighbors and often have their nuclei situated in the end of the cell forming the boundary of the hole. On the other hand the stigmata with which the name of Arnold has been frequently associated are conceived of as much more minute openings which may occur along the line of union of adjacent epithelial cells, or preferably at the point of union of several of these cells. They are made evident by the application of silver nitrate, which leaves them as black dots or rings.

[7] Virchow, Archiv, 1865, Bd. 26.

The workers in Ludwig's laboratory did not succeed in confirming v. Recklinghausen's statements as to the presence of definite preformed stomata in the diaphragm of higher animals, although Schweigger-Seidel and Dogiel did see curious little pits lined with specialized cells in the membrane separating the peritoneum from the dorsal lymph-sac in the frog. Even here, later writers have found that these are only apparent openings.

It is interesting to note that from the perusal of the literature it is almost impossible to get any clear picture of the larger preformed stomata, which have been generally assumed in the text-books as the openings of the lymphatics. The most accurate description is that of the openings between the peritoneum and the dorsal lymph-sac in the frog but these have later been proven to be closed by cells. Ranvier[8] pictured certain "puits lymphatiques" which he at first thought to be openings but later he states that they are closed by mobile cells, related to the leucocytes. These were in the diaphragm of rabbits. No one has described accurately, or drawn the actual communicating channel between the peritoneum and the lymphatic, as one might expect to find it in a section and we are left with a very vague and uncertain conception of the nature of these openings.

The question of the rings and dots, the so-called stigmata, in the silver markings outlining the epithelial cells, has been widely discussed, some stating that they are merely irregular deposits of silver while others claim that they represent actual holes. A middle position is held by other writers who think that they may represent the openings produced by various things, such as the stretching of the serosa, or the perforation of the membrane by wandering leucocytes. Muscatello looks favorably upon this latter view but leans to the idea that if one could obtain an absolutely intact, normal serous surface there would be no "*stigmata.*"

It seems absurd that with all the work that has been done on the subject there should be any uncertainty about the existence of such stomata as v. Recklinghausen and many writers after him describe, and which are generally described in the text-books of histology to-day. They present such an easy explanation for the phenomena observed that they are eagerly seized upon as a useful structure by writers on the subject who make no further investigations for themselves. Of late, however, several authors have made the statement, that the lining of the diaphragm on the peritoneal surface is quite complete and contains no preformed stomata and that even the stigmata or irregularities in the silver markings are essentially artefacts. Kolossow[9] has made especially minute researches into the nature of the peritoneal epithelium and the connection of its cells, while Bizzozero and Salvioli[10] and Muscatello[11]

[8] Traite d'histologique.

[9] Archiv für mikroskop. Anat., 1893, Bd. 42.

[10] Archivio per le Scienze Medice, 1, 2 and 3.

[11] Virchow's Archiv, Bd. 142.

also describe the structure of the serosa and find no definite stomata. Other more recent writers however declare that stomata are present.

It is the aim of this paper to control these results which differ so widely in the interpretation of the anatomy of the peritoneal wall, and further to control the results of experiments made with the purpose of discovering the path taken by solid granules as they leave the peritoneum.

It is stated by Muscatello that absorption takes places almost exclusively through the diaphragm, as shown by the differences in the amount absorbed according to the position of the animal and that probably the parietal abdominal walls are very little concerned. His experiments as to this point are not numerous, however, and the tests which he applies to determine whether or not any of the material has been absorbed are not the most accurate. Nevertheless, even though the diaphragm is not the only part of the peritoneum engaged in absorption, it is generally agreed that it is perhaps the most actively absorbing portion. The determination of the exact paths of distribution of recognizable material placed at certain definite spots in the peritoneal cavity would probably afford considerable light upon this point, as was roughly demonstrated in the study of certain actinomycotic infections of the peritoneum.[12] In those rabbits in which the actinomyces produced a recognizable nodule wherever the individual organism or a group of organisms settled, intra-peritoneal injection of a suspension resulted invariably in such a dense production of the minute white nodules over the diaphragmatic tendon that its surface was almost entirely covered. In all cases the omentum was densely studded with the nodules and contracted into a firm mass. There were generally abundant nodules in the pelvis but the parietal abdominal walls, mesentery and intestines were usually almost free or the seat of scattered lesions only. On the other hand the injection of carmine suspension into the peritoneum which results in an injection of the diaphragmatic lymphatics and the filling up of the anterior mediastinal lymph glands, also produces a diffuse pink staining of the parietal abdominal walls which on microscopical examination is found to be due to the presence of finest granules of carmine in the tissue, generally inclosed in leucocytes.

Very little stress is laid by all these writers upon the enormously active phagocytosis, which may be observed in the peritoneal cavity a short time after the introduction of granular foreign material.

This may be studied easily enough by examining the peritoneal fluid of dogs at various intervals after the introduction of a suspension of granules. There are quite marked individual differences in different animals in the rapidity with which phagocytosis occurs. Generally it has been found that after fifteen to twenty minutes very few leucocytes are to be found in the peritoneal fluid. Some of these are actually laden with pigment while others have applied themselves to masses of pigment. After the lapse of thirty minutes the activity of the endothelial and epithelial cells becomes more marked and in two dogs forty-five minutes after the introduction of the material the leucocytes, which usually are not excessively abundant at thirty minutes, had become extremely numerous and were abundantly laden with pigment. It has been found, however, that the entrance of bodies, such as extravasated red corpuscles, into the lymphatics may take place before any great exudation of leucocytes has appeared—for example in one case in which a vessel was wounded during the injection, large enough to fill the peritoneum with blood, the dog was killed twenty minutes after the injection—hardly any phagocytic leucocytes could be found but the lymphatics and the mediastinal lymph glands were full of blood.

Whether the diaphragm be the most important absorbing agent or not, it is a situation in which the study of the mechanism of absorption into the lymphatics has long been carried out and it is again with lymphatic absorption as typified here that this study is almost exclusively occupied.

In order to comprehend the mechanism of absorption it is necessary first to study in its detail the anatomy of the tissues concerned, and more especially of the tissues, if any, which separate the lumen of the lymphatic channel from the cavity of the peritoneum. It will be readily seen that the crucial point is the passage of the granules through this tissue, for once within the lymphatic the transposition of the material is an easy matter, all the mechanical conditions being entirely favorable to the progression along certain lines.

The pleural surface of the diaphragm may be readily distinguished from the peritoneal by various anatomical peculiarities, a few of which will interest us. It is found that the connective tissue bundles which show through the transparent superficial tissue lie in general parallel with one another. Large blood-vessels and nerves course through this tissue and the lymphatic trunks can frequently be seen as clear canals, branching about over the surface. When injected they are found to have a characteristic arrangement which, however, need not be described here except in its merest outlines. There are lateral semicircular canals coursing along with the lateral veins near the line where the musculature passes over into the tendinous center. From these efferent trunks pass forward to the anterior mediastinum, where they accompany the mammary veins, while others run backward to the point where the vena cava, œsophagus, and aorta penetrate the diaphragm, and accompanying these structures, pass through also to empty into the abdominal lymphatic trunks.

Extending in all directions from these main trunks on the pleural surface are branching channels with the characteristic segmentation and provided with the curious long filmy valves at each segment, which flutter like flags in the stream and have a line of closure a long way from the actual

[12] MacCallum, Life History of Actinomyces Asteroides, Centralb. f. Bakt. u. Paras., 1902, xxxi.

edge. These channels anastomose abundantly and form a network over the whole surface. Passing through the musculature of the diaphragm, from this network, are short trunks which communicate with the layer of lymphatics lying on the peritoneal side. The tissues here are rather differently arranged—the muscle bundles run for the most part parallel with one another and radially, being separated by connective tissue in which lie the parallel and likewise radially placed lymphatic canals which receive the communicating channels from the pleural side. These canals are somewhat beaded or bulged along their course, but it could not be determined that they are provided with valves. They project a little above the muscle into the overlying connective tissue on the peritoneal side. The bundles of this connective tissue layer are in general parallel with one another but diverge here and there to leave lozenge-shaped spaces, which are readily visible to the naked eye in the dog and in man often measure 2-3 mm. in length and 1 mm. in width. The connective tissue bundles and therefore also these spaces run in a direction transversely or obliquely across the radially arranged muscle fibers.

Now the parallel lymphatic canals are most abundantly connected by anastomosing channels which run obliquely or transversely across the intervening muscle bundles and lie generally nearer the peritoneum than the radial trunks themselves. Often some of these running obliquely, join in the middle between two of the radial trunks to form a sort of secondary radial trunk which lies upon the surface of these muscle bundles. Others arch up toward the peritoneum in their course from one radial trunk to another. These are sometimes relatively simple fusiform tubes, while at other times they branch and interanastomose with one another in a complicated way, often forming secondary connections with other parts of the trunks by means of very narrow canals. In general all of these anastomosing channels open into the radial trunks by exceedingly wide and numerous openings, so that there is the freest possible intercommunication. In their arching course they come to lie in the spaces between the connective tissue fibers of the layer overlying the muscle, that is in those lozenge-shaped spaces which are described above, and here they are separated from the peritoneal cavity by an extraordinarily thin layer of tissue only. This somewhat complicated arrangement is perhaps best described by the drawing which shows the extremely rich network of vessels. (Fig. 1.)

It will be seen that these form the most favorable situations for the entrance of materials from the peritoneum and undoubtedly they are especially adapted to that purpose. These sac-like channels are easily seen with the naked eye, even without being injected or distended. They appear as small diamond-shaped or fusiform, clear areas, generally a little sunken below the surrounding tissue, but when distended they are elevated above the surroundings as tiny vesicles. In the diaphragm of man and the dog the covering of transparent tissue is easily seen. In the ox's diaphragm, however, they look like mere holes or depressions on the surface and it is only by picking up with a forceps out of the depth of the depression, the membranous roof, that we see the real nature of the structure. In the rabbit they are elongated and radially placed—especially developed in the centrum tendineum, where they lie between the radial fibers. In dogs and man, however, they seem more abundant over the musculature of the diaphragm.

Now when granular material is injected into the peritoneal cavity we find on examination of the diaphragm after a time that these superficial anastomoses or blind sacs, or, as we for brevity call them—lacunæ—are injected with the granular substance and from them we can trace the material into the anastomosing trunks of the pleural network, into the efferent trunks, and then very readily into the mediastinal lymph glands. It is interesting to note that even when actual entrance of the pigment into the lacunæ has not occurred it is deposited almost exclusively upon their roofs, possibly because in their collapsed condition they lie somewhat below the surrounding level. The roofs of these lacunae must, therefore, be of especial interest to us in determining the mechanism of the absorption.

It is found that while they lie between the connective tissue bundles and are thus situated obliquely or transversely over the muscle, they are themselves traversed by other finer fibrils which cross them obliquely or transversely and which consist no doubt, merely of diverging superficial fibers of the main layer. When, therefore, one looks down upon one of the lacunæ in its distended condition one sees these fibrils cross its bulging surface like ropes across a full sail. Elastic fibers are present in numbers, often forming definite layers throughout the superficial connective tissue of the diaphragm, and they too, often stretch across the roofs of the lacunæ.

The further structure of these tissues can be best made out in thin paraffin sections of tissue, fixed in Zenker's fluid, cut vertically and in sections parallel with the surface of the diaphragms, which have been treated with nitrate of silver or by the method of Kolossow.

The lymphatics themselves can be beautifully demonstrated by an injection of a 0.5% solution of silver nitrate, followed by agar which in cooling keeps the channels widely distended and makes it possible to view the smoothly stretched lining. (Fig. 1.) By this method it is found that the endothelial lining is an exquisitely complete one. Similar methods employed in demonstrating the continuity of the endothelial lining of the lymphatics of the skin were described in a previous paper but if possible the accuracy of the adjustment of the cells to one another is shown here even more beautifully than was the case in those channels. It is generally found that the lining endothelial cells are rather elongated in the radial trunks—often their outlines are zigzag and irregular. In the wall of the lacunæ nearest

the radial channels this irregularity of outline of the cells is very marked, while on the bulging roof they appear as if drawn out and stretched into more regular outlines. These cells of the roof are perhaps rather smaller than the others —they are long and narrow, their long diameter sometimes lying parallel with that of the channel, sometimes across it. Over the whole surface of the distended lacunæ, however, they are adjusted to one another with the utmost delicacy and accuracy—there being in the many lacunæ examined no signs of a preformed opening. Even the rings and dots of the silver deposit—the stigmata—are almost entirely lacking, the intercellular lines being extremely delicate and fine.

The question of those curious rings and dots which are produced by treating the endothelial and epithelial cell layers with silver is one which is not yet satisfactorily answered. Certainly they can hardly be dismissed as entirely the result of accidental irregularities in the action of the silver, although this may account for the grosser of these deposits in cases in which the tissue was not previously carefully washed, or in which too strong a solution was used and allowed to remain too long in contact with the tissue or insufficiently removed by washing with distilled water. In these cases there appear black granules and masses which are apparently due to the presence of albuminous fluids upon the surface or to the gross precipitation of the silver from the solution on long contact with the tissue. If all these precautions are observed, however, and a solution of silver nitrate used which is not more concentrated than 0.5 per cent, such gross precipitates are avoided. Further, as has been repeatedly pointed out, stretching, drying, inflammation and a great variety of other processes injurious to the tissue favor the production of these appearances. So, for example, in serous surfaces in which the rather violent stretching action of artificial respiration has continued for a long time, it is usual to find the inter-epithelial lines much widened, especially over the lacunæ.

Even with the exercise of every precaution, however, there appear some of these markings—in the epithelial layer they take the form of solid widenings of the intercellular line or of rings intercalated in these lines. No doubt these may be explained as due to a partial separation of the cells—an enlargement of the intercellular space which, as Kolossow has shown, normally exists and a separation of the intercellular bridges which cross this space. Whether this will explain all of them is uncertain, but there seems no doubt that the epithelial cells can easily become separated and then there are conditions produced which favor the greater deposit of the silver between them.

In the endothelium of the lymphatics the same minute rings appear in small numbers along the intercellular lines. Now Kolossow insists that the type of union of the endothelial cells is quite similar to that of the epithelial and we have no reason to doubt that this silver deposit would react in the same way there. There is, however, another sort of ring intercalated in the intercellular line which may best be explained in another way. These are not like the minute darkly outlined rings just described, but larger and bounded by a more or less irregular outline. Their central portion is granular, resembling exactly the bodies of the endothelial cells—indeed these rings look like very small cells or parts of cells intercalated in the endothelial line and it seems most probable that they are actually parts of endothelial cells nipped off as it were by the gradual narrowing of the neck of one of the numerous processes of the original cells, as shown in Fig. 2, in which from A to E one may trace the progress of formation of such rings. They no doubt form an integral portion of the wall of the lymphatic—sometimes they may actually appear to lie in the body of one of the larger cells and connected with its margin only by the line along which the edges of the large cells have come together so as to completely isolate this small mass. (Fig. 2 E.)

This forms one structure of the roof of the lacunæ. Another important one is the layer of peritoneal epithelial cells, which have given rise for a long time to the most vigorous discussion. Their nature has been investigated by a great variety of methods, with a very remarkable variety of results. They have been described as flattened cells arranged edge to edge—the method of approximation of the edges remaining a little obscure. It has long been the opinion of various authors that the cells are fixed to one another by a sort of cement which on being treated with silver nitrate forms with that reagent a silver albuminate which blackens on exposure to light. These authors have

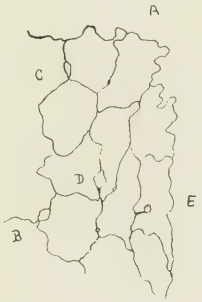


Fig. 2.—Endothelium of a lymphatic lacuna showing the process of separation of small portions of the cell body from the elongated processes.

described them as polygonal cells, ordinarily homogeneously arranged, but sometimes arranged about an opening in which case the nuclei of the cells approach the opening. In other instances certain groups of cells are smaller and more densely granular than the remainder—these are thought of as germinating cells and so described by Klein.[13]

The only advance in knowledge of the subject in recent years has been made by Kolossow,[14] who carried out a detailed study of these cells by the aid of a method in which osmic acid was used as the fixative agent, followed by a tannic and pyrogallic acid solution, the action of which is analogous to that of the photographic developers. By this means he showed that a much more complicated structure than had been previously supposed existed in the epithelial cells. He found that the cell body containing the nucleus was of granular protoplasm and relatively small,

[13] Atlas of Histology.
[14] Archiv für mikr. Anat., 1892, Bd. 42.

being quite widely separated from the adjacent cells and connected with them only by protoplasmic processes or bridges. Over these gaps, however, the perfectly hyaline, thin, flat, superficial layer of the cells extended like the widely projecting eaves of a flat-topped house, to meet or almost meet a similar projecting layer from the next cell. These hyaline plates, too, are connected by intercellular bridges and are covered over on their free surfaces with long thin cilia. When such cells are looked at from above, the fine line between the hyaline plates is scarcely visible, but the slightly irregular margin of the underlying granular cell with its protoplasmic bridges, shows through and one sees between the cells a beaded line of clear spaces which are the spaces between the granular intercellular bridges, showing through the hyaline plate.

Everything in this description which has been accepted also by Muscatello has been confirmed in our studies—the cilia are thickly set on the surface and quite conspicuous in sections. It may be questioned, however, whether there is not some shrinkage in the cells so treated to produce the wide gaps between their protoplasmic portions. Indeed in several instances the picture produced has been rather that of a series of stellate cells connected only by the long processes which stretch out from the protoplasm, tightly contracted about the nucleus. The gaps thus left between the cells are very large indeed.

With the same method it is sometimes observed that the cells contract away from one another and assume in sections an almost spherical form. It has often been observed, however, in preparations of inflamed serous surfaces fixed in Zenker's fluid that the cells do remain in contact superficially, while their cell bodies are separated and we have even found these spaces occupied by leucocytes.

Both Kolossow and Muscatello found by this method, which is more refined than the silver method in that irregular precipitates are avoided, that the peritoneal epithelial lining is a complete one. They fail entirely to find any apertures with special arrangement of epithelial cells about their margins, such as have been described by several authors, and they see nothing of the groups of germinal cells spoken of by Klein and others. Briefly it may be stated that our results agree entirely with those of Kolossow and Muscatello, for search through a great number of preparations has failed to reveal anything which could be considered a preformed hole in the peritoneal lining. An especially careful scrutiny of the roofs of the lacunæ in the dog's diaphragm was made but nowhere in the hundreds of roofs examined could any such aperture be found—the frequently described radial arrangement of cells about a central hole being entirely wanting. The partial separation of the cells from the contraction of their protoplasm, as described above, has, however, its significance, as will appear later.

What then, we must ask, is the nature of the tissue which lies between the peritoneal epithelium and the endothelium of the lymphatics. Bizzozero and Salvioli,[15] Vincenzi,[16] and Muscatello[17] have directed their attention especially to this point and agree in describing a homogeneous basement membrane which lies directly beneath the epithelium. Bizzozero and Salvioli determined the presence of this by maceration of the tissue in Muller's fluid and alcohol, after which they were able to tear off the membrane in small strips. This they found to be imperforate and homogeneous everywhere except in those areas in which it formed part of the roof of the lymphatics in the diaphragm and there it was pierced with numerous fenestrations. Vincenzi found similar fenestrations in the membrane lining the tunica vaginalis testis. Muscatello adopted a similar method of investigation and studied the membrane in many situations in the peritoneum. He found that it was easy to strip off quite large pieces from the intestine and several other organs, while from some others in which the tissues were denser, it became far more difficult. He was able to see niches and depressions in the surface of this membrane in which the epithelial cells lay. Only over the lymphatics of the diaphragm could he find any fenestrations and from this he draws his conclusion that it is only in the diaphragm that the absorption of granular material occurs.

Maceration as practiced by these authors has given us no very satisfactory results, but some light upon this point has been obtained by the study of flat and vertical sections treated in various ways, the results of which may be detailed briefly. The fibrous tissue which makes up the bulk of that layer in which the lymphatics lie embedded gives off, as described above, divergent bundles which run obliquely across the lymphatics and thus come to lie in the substance of their roofs. Sometimes these strands are so abundant that the cross section of the roof of such a lacuna looks like a string of beads and from the projection of the strands into the lumen of the lacuna its cavity becomes very irregular in form. This fibrous tissue is extraordinarily rich in elastic fibres, which lie in more or less definite layers and accompany the fibrous strands into the roof of each lacuna. From the coarser elastic fibres accompanying these strands, fine branches are given off which run in all directions over the roof of the lacuna so that it becomes very richly supplied with elastic tissue. If now we examine a flat section stained with Van Gieson's or Mallory's stain for connective tissue, or still better one treated with a combination of silver nitrate with Kolossow's osmic-tannic acid stain, all of which leave the elastic fibres very inconspicuous, we can make out in the roofs of the lacunæ between the epithelium and endothelium a lattice work of fibres which has a general resemblance to a fenestrated membrane. (Fig. 3.) Close examination shows, however, that it really consists of anastomosing bundles of fibrils which form more or less rounded meshes. These fibrils stain rather pale blue with Mallory's method—

[15] Bizzozero and Salvioli, Archivio per le Scienze Medice, 1, 2, 3.
[16] Vincenzi, ibid.
[17] Muscatello, loc. cit.

pale red with Van Gieson's and stand out sharply as greenish grey on the application of the other method described. In vertical sections the lattice work appears as a rather thick band directly underlying the epithelium in which sometimes all the cords of fibrils are cut across so that we have the appearance of a beaded line. (Fig. 6.) In other cases one of the strands may be cut longitudinally and the others obliquely, producing variations in appearance. The coarse fibrous strands interrupt this line or they may lie beneath it, holding the endothelium of the lymphatics away from it. They are often invested by its prolongations. (Fig. 6.) At the margin of the lacunæ, the lattice work thins away and runs on beneath the epithelium and over the most superficial layer of elastic fibrils. Everywhere, aside from the lacunæ, the epithelium is bounded below by the extremely delicate basement membrane which appears in section as the finest line, even when viewed with the oil immersion objective. Whether the lattice fibers in the roof of the lacunæ are directly continuous with this I cannot definitely determine, but one receives the impression that this is the case. It seems inconceivable that even with the most careful maceration this extraordinarily delicate basement membrane could be torn off in pieces of any size in an entirely isolated condition. Our most successful isolation preparations included always a good deal of the underlying tissue.

Elastic fibrils and scattered connective tissue cells make up the remainder of the tissue which separates the epithelium from the endothelium of the lymphatic—a tissue which is thus seen to be far from compact and which on section shows abundant wide crevices and spaces the significance of which will also appear later.

The endothelium in these sections passes as an extremely delicate line over the whole inner surface, bulged here and there by a relatively thick nucleus and sinking into the spaces in the lattice work or held up by the coarse fibrous strands. According to the degree of distension of the lacuna this irregularity is greater or less. When the lacuna is widely distended the endothelium is drawn out smoothly over the tissues of the roof and all irregularities are obliterated. Study of very many sections shows no evidence of break in the continuity of this layer in spite of its irregularity.

Further attempts were made to be sure that the roofs of the lacunæ are indeed without definite apertures. As stated above they never could be seen either in the peritoneal epithelium nor in the lymphatic endothelium, but it seemed that an irrefragable proof might be obtained if we could distend these lacunæ with a colored injection mass. Of course it can be conceived that a canal opening very obliquely into the lacunæ might be shut valve-like by the distension of the lacunæ, but it seems *a priori* extremely improbable that such an arrangement could exist, especially since the roof of the lacuna is so extraordinarily thin,—furthermore such a canal should be discoverable on section. At any rate bearing this in mind most numerous injections were made, generally under the stereoscopic microscope in the fresh diaphragm—it is easy enough to insert the needle into the superficial connective tissue on the peritoneal surface and inject two or three or more of the parallel trunks with all their anastomoses and blind appendages. Usually such an injection takes the form of a straight band running from the central tendon radially toward the periphery of the diaphragm, over which the obliquely placed lacunæ bulge up and produce a corrugated appearance on the surface. They may be distended to their greatest capacity, putting the fibrils which traverse them on the stretch and bulging between them as thin walled sacs. With the removal of the pressure they collapse and may be redistended over and over again. With all this, leakage does not necessarily occur—it is easy to inject the whole breadth of the diaphragm without the least leakage and even to gently distend the lacunæ. When the surface is exposed to the air until the moist glisten is slightly lessened it is especially evident that there is no leakage. In such a distended system one may with a camel's hair pencil brush the colored liquid out of one lacuna back into the trunk and into another lacuna, when with the relaxation of the pressure it returns to refill the first lacuna. With injections of air one can distend these lacunæ into shining bubbles which remain distended a long time. Certainly one receives the impression that they are sacs with complete walls and without any such holes as are described in their walls large enough for two or three red corpuscles to go through abreast. This is not the whole truth however, for by slightly raising the pressure one *can* make the fluid appear on the surface—it oozes through slowly, appearing like tiny dew-drops. If we use a solution, the fluid which comes through is colored too, but if we use a suspension such as carmine or milk, the fluid which filters through is clear, the suspended particles being left behind. This seems to be merely a process of filtration under pressure through a thin membrane and does not interfere with the idea of the completeness of the membrane.

If now we increase the pressure still more we may be able to observe suddenly a whirl of pigment granules bubbling up from the lacuna through the roof at some point and flowing over the surface. This is explosive in its appearance and it has seemed each time it was observed to be due to the rupture of the roof of the lacuna by the relatively high pressure employed. It is hard to conceive that these things should be possible if there were wide open communications between the lacunæ and the peritoneal cavity. Indeed it seems almost inevitable that were there any free openings at all there would appear droplets of milk, as such, on the surface or of the india ink, as such, instead of which the surface remains for a long time without any transudate, after which with continuance of the pressure there is a general oozing of clear fluid.

To resume then, we have the peritoneal cavity lined by a complete layer of peculiar epithelial cells which lie on a basement membrane uniformly thin except where it overlies

the lymphatic lacunæ in which position it is represented by a lattice work of fibrils separating the epithelium from the surface of the lymphatic. Approaching the peritoneum at these points are the oval sacs or lacunæ which are the absorbing terminals of the diaphragmatic lymphatics and which while possessed of a complete lining of endothelium are separated from the peritoneal cavity only by the loosely woven connective tissue and the peritoneal epithelium.

We have therefore to deal with at least three elements in the absorption of material from the peritoneum, no matter whether such materials pass directly through the roofs of the lacunæ or first through the peritoneal epithelium at a distance from them and then by a circuitous route through crevices in the tissue to the walls of the lymphatic channel. These three elements which can afford a certain obstruction to the progress of the absorbed material are then the peritoneal epithelial layer, the basement membrane and the lining endothelium of the lymphatic.

Now in the preceding paper, above referred to, it was shown that the walls of the lymphatics in several situations at least are composed of a complete layer of endothelial cells without preformed openings and when we come to explain the entrance of solid materials into such channels we are met by difficulties. The simplest and readiest explanation which was offered in that paper is that phagocytic cells possessed of automatic motility may carry the granules in, or the vital phagocytic activity of the endothelial lining cells may be capable of effecting an entrance for such granules. To explain the entrance of free granules it seems that we must have some propelling force and then we must have either open holes in the walls or the connection of the endothelial cells must be so lax that the force is sufficient to drive granules between them into the lumen. This last idea is the one adopted by Muscatello although it is certainly at first sight not a very satisfying one. It is the idea expressed also by Fleiner[18] in his elaborate researches on the absorption of pigment from the alveoli of the lung.

Mention has already been made of the extraordinary activity of the leucocytes as well as the fixed cells in taking up any foreign materials. If one inject a suspension of carmine into the peritoneum of a rabbit and after a few hours examine the diaphragm the lacunæ will be found sprinkled over with leucocytes and their lumina largely filled with them. Indeed if one dissolve out the carmine,—the acetic acid concerned in fixation with Zenker's fluid is sufficient to effect this—and then stain the diaphragm in toto in a nuclear stain, it will be found that the lacunæ appear densely injected with blue which on closer inspection is seen to be due to the leucocytes which crowd its lumen. So, too, we find the pleural network full of them and the lymph sinuses of the mediastinal lymph glands are practically packed with phagocytic leucocytes. So, too, in the dog—forty-five minutes after the injection of a large quantity of diluted india ink into the peritoneum the fluid in the peritoneum is found to be practically a thick suspension of amœboid leucocytes, a great many of which are laden with pigment granules. The lacunæ in the diaphragm are found to contain a great quantity of pigment, a large part of which is contained in leucocytes. Leucocytes generally laden with pigment swarm about over the surface of the lacunæ and such laden leucocytes can actually be seen in large numbers in sections *making their way with their load of pigment through the roof of the lacuna.* (Fig. 4.) These are, as shown in the drawing, greatly distorted and drawn out, their protoplasm and nucleus stretched out into a thread in the advance through the tissue and drawing behind usually a larger bulbous portion carrying the pigment. Often one can see four or five going through different points in the roof of one lacuna. That they are entering and not going out seems the only reasonable conclusion from the general direction of the stream, even if one cannot draw any absolute conclusions from the appearance of the leucocyte in transit.

The epithelial cells and especially those over the lacunæ are frequently phagocytic and become loaded with pigment. Similarly the connective tissue cells underlying them may often show a pigment content, especially when they lie just at the edges or on the roof of the lacuna. Finally the endothelial cells in the lymphatic become swollen and loaded with pigment.

From all this it may with reason be concluded that phagocytosis at least plays a very important part in the transportation of pigment from the peritoneal cavity to the cavity of the lymphatics, for not only have we leucocytes wandering into the lymphatics and carrying pigment but the epithelial and endothelial cells themselves take up the pigment and may perhaps be able to transfer it, one to the other. Leucocytes laden with pigment may also be seen wandering in the crevices of the tissue outside the lymphatic but doubtless these later enter the lymphatics also. We cannot of course tell when we find a leucocyte laden with pigment in the lymph gland that that leucocyte has brought the pigment from the peritoneum—it may have merely taken up free pigment brought to it in the lymph gland, but when we see leucocytes actually penetrating the barrier between the peritoneum and the lymphatic with its load of pigment there seems to be but little doubt of its significance.

The importance of the respiratory movement of the diaphragm in the aid of absorption from the peritoneum has always been emphasized and indeed it is not to be underrated, as will be seen later. The mechanism by which it produces a pumping action is simple enough—in inspiration when the diaphragm is relatively flat and contracted the spaces between its constituent muscles and connective tissue fibres become compressed and conversely in expiration, when it arches up into the thorax these elements separate and the intervening spaces are widened. It is very easy to see

[18] Fleiner, Virchow's Archiv, 1888, Bd. 112.

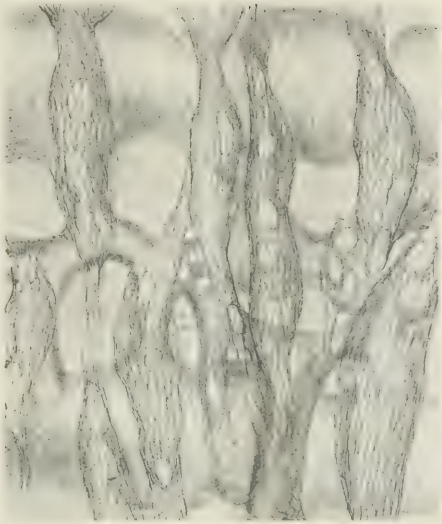


FIG. 1. Diaphragm of dog in which the lymphatics have been injected with silver nitrate. The lacunæ are intended to appear as arching anastomoses between the radial trunks which lie at a lower level and to communicate with them freely by wide openings.



FIG. 3.—Superficial layer of diaphragm stained with silver nitrate, &c., showing the lattice work of fibres overlying the lacunæ.

therefore that the lymphatic channels which lie in these spaces are also alternately distended and compressed—in other words there is an actual pumping action carried on incessantly by the respiratory movements. In order to determine whether or not this is necessary to absorption in the living dog the elimination of respiratory movements were brought about by the wide opening of the chest. The lungs were drawn out as far as possible and active artificial respiration kept up, so active that no impulses came from the nervous system to the diaphragm to produce its contraction. When the dog was then tipped up by the elevation of the hind legs the diaphragm bulged slightly into the thoracic cavity and remained quite quiet. Carmine in suspension was then injected into the peritoneal cavity and the dog kept alive for two hours. At the autopsy it was always found that in spite of the absence of respiratory movements there was a fairly abundant injection of the lymphatic lacunæ and enough carmine reached the anterior mediastinal glands to color them bright red.

There seems no doubt therefore that the vital activity of the cells—phagocytosis—is capable of producing by itself an injection of the lymphatics and is of extreme importance in the absorption of granular material.

That it is not the only factor, however, is shown by the presence of free pigment granules within the lacunæ and in order to determine their mode of entrance it was decided to eliminate one by one the possible adjuvant factors.

The dog was killed and partly eviscerated and then hung up with artificial respiration so that the granular material might be poured upon the concave peritoneal side of the diaphragm which moved up and down with the expansion and contraction of the lungs. This eliminated in large part the agency of the leucocytes, since the peritoneal cavity was washed out, and in other experiments this factor was more absolutely excluded by washing out the blood-vessels with salt solution. On continuing the artificial respiration for two or three hours one generally succeeded in producing a very definite injection of the lymphatic lacunæ, the pleural network and of the mediastinal lymph glands. If before beginning the respiratory movements one portion of the diaphragmatic surface were brushed with a camel's hair pencil, it was found afterward that that area was much more deeply injected than the remainder. Evidently here one brushed off the roofs of the lacunæ and the pumping action of the diaphragm readily filled such violently opened channels. The possibility therefore suggests itself that even in the other case the absorption might be due to slight traumatisms injuring the epithelium of the peritoneal surface, and other experiments were instituted in which in the removal of the abdominal viscera extreme care and gentleness were observed, the diaphragm was not once approached and the liver left in situ. In this case, however, the injection of the lacunæ was quite as extensive and quite as general.

With the respiratory movement therefore it is possible to produce an injection of the lacunæ without the aid of the phagocytic leucocytes.

It may be objected, however, that the active phagocytosis displayed by the endothelial and epithelial cells may have aided greatly in this transmission of pigment. In order to exclude this, various reagents were applied to the surface of the diaphragm before the granular material was poured on with the aim of either paralyzing these cells or killing them outright. Solutions of quinine for example were used. Water heated to 65° C. was allowed to stand in the diaphragm for three to five minutes. Even a 10% solution of formalin was poured on the diaphragm and allowed to stand for two, five, and twenty minutes, respectively. In another instance silver nitrate was poured over the surface of the diaphragm. After this the granular material was poured on and artificial respiration carried on. In all of these cases a small amount of absorption occurred—certainly as might be expected after the use of such violent coagulating agents, the absorption was not as free as in the fresh diaphragm but some of the granules did gain access to the lymphatics and in some cases, e. g., after the formalin the mediastinal glands became deeply injected. Similarly a dog was killed and allowed to lie in the ice-box for four days until all phagocytic activity on the part of the peritoneal epithelium had probably been destroyed. In spite of extreme rigor mortis it was found that artificial respiration produced, when the dog was eviscerated and carmine poured on the diaphragm, some absorption of the pigment into the lacunæ. There was evidently so great a coagulation of the tissues that the lymphatic trunks and lymph glands in the anterior mediastinum did not become injected.

By this means we have eliminated everything which could bring about the absorption except the mechanical agency of the respiratory pumping movement. True it is, too, that in so doing we have lessened the amount of absorption to a small fraction of what it was when the living cells were aiding by their phagocytic activity but nevertheless there is left the fact that the absorption is not exclusively dependent on phagocytosis.

In order to determine the paths of the absorption all these diaphragms were fixed and numerous sections cut from various portions of each.

Practically two histological pictures only were obtained from all these various experiments—either phagocytosis played a part or it did not. In the first case the appearances have already been described and pictured—in the second one found the cells which go to make up the tissue practically passive and the path of the entering pigment can only be judged by the study of its distribution in the sections. Since the principle is identical in all of these cases in which the vital activity of the cells is excluded, it may be well for the sake of brevity to describe the results of one experiment in which the distribution is best seen. Such an experiment is that in which diluted india ink is poured upon the concave surface of the diaphragm of a

freshly killed dog and artificial respiration carried on for two or three hours. In such a case phagocytosis, if it occurs at all, is negligeable—no cell enclosing pigment has been found in any of the sections, probably largely because the cells still surviving are not kept warm and their amœboid motion ceases. The entrance of the ink in such a case therefore occurs just as it does in those cases in which the tissue cells are actually killed.

It is found that the epithelial cells are slightly contracted and rounded off so as to separate a little from one another. This is not invariable but is very common—sometimes it produces such a convexity of the free surface, of each cell that the cilia become separated and radially arranged.

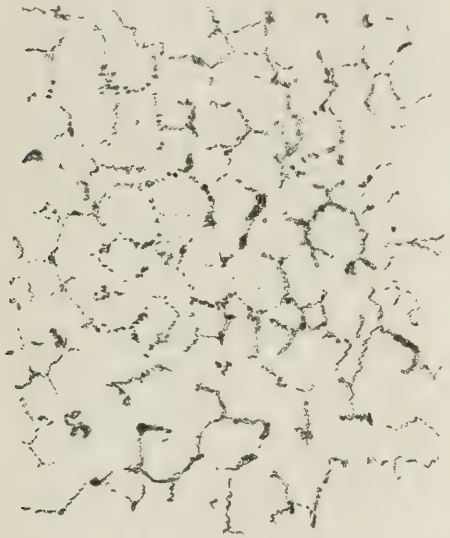


Fig. 5.—Surface of peritoneal epithelium, showing mode of distribution of pigment injected into the peritoneum.

On the surface of the epithelial cell layer the pigment is scattered abundantly in fine granules but when we examine such a surface with the microscope it is found that the distribution is not a completely irregular one but that as shown in Fig. 5, the granules are ranged along the outlines of the epithelial cells in such a way as to roughly imitate the picture produced by treating the peritoneum with silver nitrate. It is evident then that instead of pouring in a vortex into a single hole or a series of large holes in the diaphragm the pigment granules press through between each two cells and indeed all along the margin of each cell—in every part of each intercellular space we find them. In section it is seen that these granules often form little masses which lie on the basement membrane between the cells, and granules are even found running in long lines beneath the cells and between them and the basement membrane.

Evidently these epithelial cells form a very slight obstruction indeed to the entrance of pigment. Often it is found even to extend into the crevices of the connective tissue away from the lacunæ but it is more especially into the lacunæ themselves that its wandering may be traced. (Fig. 6.) Here, as it will be remembered, we find at most a lattice work of fibres between the epithelial and endothelial layers and through this and among the underlying connective tissue fibrils the granules may be traced down to the endothelium. Sometimes they are arranged singly and in small groups which adhere to the connective tissue fibrils and outline them while at other times they are packed together in a dense mass which extends through the tissue and more than anything else suggests the idea of the wide open stomata packed with pigment. These pigment granules may run along the surface of the endothelium or bulge it into the lumen of the lymphatics and where there are also masses within the lumen it is difficult or impossible to determine the line of the endothelium. The exact anatomical relations are thus very much masked by the presence of so much pigment, but from the knowledge of the anatomy of the tissues which we have gained, we must believe that in all these cases the pigment masses without the lymphatic are continuous with those within the lumen through the intercellular spaces between the endothelial cells, produced by a relaxation of the connection of these cells with one another, a separation which is increased by the greater and greater accumulation of pigment. In every case the pigment comes to lie directly upon the endothelium and as may be seen when such specimens are injected with silver nitrate, becomes scattered over the surface, the granules being most abundant along the margins of the endothelial cells, although they are by no means so abundant as to outline these cells. They show no especial relation to any accidental silver rings which may occur. To explain the passage of these granules through the endothelial wall into the lumen of the lacuna it seems necessary to suppose that the connections of the endothelial cells are so lax that the violent pumping action of the respiratory movement is enough to force material between them when they come to form the only obstruction to its entrance.

In reality, as is evident, this is very near practically to v. Recklinghausen's idea of stomata but it differs in holding the peritoneal epithelium as a complete layer of cells distinct from the lymphatic endothelium and not passing over into them through any communicating channel. It admits however a laxity in the connection of these cells with one another which allows of all the functional possibilities provided for by v. Recklinghausen's lymphatics in open communication with "saftkanälchen" or lymph canaliculi.

We have therefore in the absorption from the peritoneum a process in which a very important role is played by the phagocytic cells but in which the mechanical aspiration

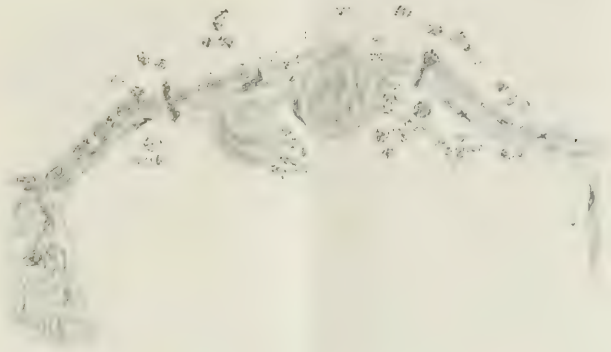


FIG. 4.—Roof of a lacuna in section showing the entry of pigment by the aid of phagocytic leucocytes. Epithelial and endothelial cells are also phagocytic.



FIG. 6. Roof of a lacuna in section showing entry of free pigment between the cells. Cross sections of the lattice work of fibres are seen in the roof of the lacuna.

of granules through the lax cell membranes by the respiratory movements is also possible.

Efforts were made to confirm these ideas or at least to shed additional light upon them by the study of the course of development of the diaphragmatic lymphatics and of the peritoneal cavity in embryo pigs. It was found practically impossible to inject the lymphatics of the diaphragm in very young pigs or indeed in any embryos from the thoracic duct, apparently because of the intervening lymphatic glands. The earliest stage in which an injection could be obtained by direct puncture of the diaphragm was that of 40 mm. but by staining the whole diaphragm in nitrate of silver (½% solution) it is possible to demonstrate endothelium lined lymphatics in the pig of 35 mm. Now the peritoneal cavity is fully formed and separated from the thoracic by the diaphragm at an earlier period than this, so that it seems entirely probable that the lymphatics have secondarily grown into the diaphragm from its edge and have later established the intimate relationship with the peritoneum described above.

From these studies then, we find no support whatever for the statement that there exist open communications between the peritoneum and the lymphatics, nor can we uphold the idea that the peritoneal cavity forms a part of the lymphatic system. Each of these cavities is lined with cells which retain their specificity throughout and nowhere merge into one another or into the adjacent connective tissue cells. Each develops independently and it is only later that they come into such intimate relationship that the transfer of materials from one to the other is relatively easy. The idea of the complete specificity of the endothelial cells of the lymphatics was expressed also in the previous paper mentioned and has since been confirmed—indeed one might say proven—by the embryological investigations of Dr. Sabin. And it does not interfere with the truth of these statements, that we find that the individual cells in any of these membranes are separable by adequate forces and that the mechanical violence of the respiratory movements is sufficient to force fine granules between them.

ON THE OCCURRENCE OF DIASTOLIC MURMURS WITHOUT LESIONS OF THE AORTIC OR PULMONARY VALVES.

By Richard C. Cabot, M. D., and Edwin A. Locke, M. D., of Boston.

Two years ago we made a study of the clinical records and autopsy findings of all the cases which had died at the Massachusetts General Hospital with signs supposed to be due to valvular heart disease.

The chief object in this study was to determine in what valvular lesions diagnosis is most frequently correct, so far as autopsy can be made a test of correctness. In brief the results of this work were to show that in this series (153 autopsies) *mistakes in diagnosis* were most frequent in tricuspid regurgitation and *least frequent in aortic regurgitation.* Although there were several cases in which a shrivelled aortic valve (unsuspected during life) was found at autopsy, there was not a single case in which a diagnosis of aortic regurgitation made during life failed to be substantiated at autopsy.

In view of these facts it was a matter of considerable surprise to us to see during the past year four cases in which, largely owing to the presence of a diastolic murmur, aortic regurgitation was suspected during life, but, at autopsy, normal aortic valves were found.

Brief summaries of these cases follow:

Case I.—Uncompensated cardiac disease in an adult alcoholic. Heart slightly enlarged transversely. Visible arteries pulsate strongly. Pulse irregular, low tension. Systolic murmurs in aortic and mitral areas.

Diastolic murmur in 3d and 4th intercostal spaces, close to left sternal margin. Urine of passive congestion (apparently). Blood normal. Death 11 days after entrance.

Autopsy.—Cardiac valves and cavities normal. Aorta 8 cm. in circumference. Hypertrophy of left ventricle. Chronic interstitial nephritis. Other organs not remarkable.

Case II.—Three weeks orthopnœa with œdema of legs and face in a very anæmic woman 20 years old (scarlatina in childhood). Red cells 2,800,000, hæmoglobin 20 per cent. Marked transverse enlargement of heart. Pulse 120, regular. *high tension. Diastolic murmur loudest over 4th and 5th left costal cartilages.* Urine 1460 cc., 1009 in specific gravity. Albumen ⅛ per cent. No casts.

Autopsy.—Hypertrophy and dilatation of the heart. *No valvular lesion.* Aortic valve 5.5 cm. in circumference. Kidneys show lesions of chronic glomerulo-nephritis. Other organs not remarkable.

Case III.—Woman, 34, alcoholic, very anæmic from profuse and frequent nose-bleed and from a recent post partum hemorrhage. Red cells 840,800. Slight transverse enlargement of the heart. *Diastolic murmur loudest over 4th left costal cartilage.* Systolic murmurs at aorta and mitral areas. "Flint" murmur at apex. Corrigan pulse, low tension. Urine of diffuse nephritis. Died in 3 days.

Autopsy.—Fatty heart; valves and cavities normal. Fatty kidneys. Yellow marrow (fatty).

Case IV.—Typical pernicious anæmia. At entrance (after exertion) a diastolic murmur along left sternal margin. Later this murmur disappeared. Death four months later.

Autopsy.—Ordinary lesion of pernicious anæmia. Heart fatty. Valves and cavities normal.

Conditions and Occurrence.

Diastolic murmurs, aside from those due to injury or deformity of the aortic or pulmonary valves, have been known to occur under each of the following conditions:

1. In association with dilatation of the aorta.
2. In association with intense anæmia.
3. In association with tuberculosis of the lungs and pleura, and in other conditions involving an abnormal suction or pulsion exerted by the heart upon neighboring portions of pulmonary tissue ("cardio-respiratory murmurs").
4. As an accentuation of a venous hum transmitted from the neck veins or produced in the vena cava superior.
5. In association with mitral disease and dilatation of or hyper-pressure in the pulmonary artery.

Only the first three of these conditions will be discussed in this paper.

We find no mention of diastolic murmurs without valvular lesions or aortic dilatation in the text-books of Osler, Musser, Tyson, Anders, Da Costa, Wood and Fitz, The Twentieth Century Practice, Loomis-Thompson, Allbutt, Gibson, Broadbent, Bramwell, Strümpell or Charcot and Bouchard.

I. *Diastolic Murmurs supposed to be due to Stretching of the Aortic Ring.*

This class of cases has been long known and is mentioned in most modern text-books. Corrigan[1] was apparently the first to maintain that if the aortic ring was stretched or dilated as the result of aneurism or diffuse dilatation of the arch, a genuine regurgitation of blood might occur with intact aortic valves. Two cases with autopsy are adduced in support of his belief, in which the valves were "nearly quite sound" but in which a double murmur (systolic and diastolic) was audible over the base of the heart and over the larger arteries springing from it.

Aran[2] mentions a similar case: "Les valvules sont épaissies et presentent des légères indurations à leur base, mais elles sont mobiles." The aortic ring was dilated to "deux pouces, dix lignes de circonference."

Besnier[7] heard a diastolic murmur and suspected aortic regurgitation in a case presenting at autopsy "une légère dilatation uniforme et regulier de l'aorte à sa sortie du péricarde; elle n'offre ni plaques calcaires ni atherome." The aortic valves were "minces, souples, lisses, sans adhérence ni induration."

Similar cases were recorded by Bellingham,[8] Peacock,[5] Perls,[6] Guttman,[8] Cockle,[9] Pel,[10] Chauffard,[11] Finlayson,[12] Massalongo,[13] Bouveret,[14] Renvers,[15] Jacquet,[16] Dombrowski,[17] Bonnett,[18] Pitt (8 cases),[19] and Klein.[20] [See also a discussion in which Farbringer, Leyden, Gerhardt, Litten and others took part.]

In Finlayson's and Renvers' cases the aortic valves were sufficient to the water test post mortem. In Dombrowski's case the aortic orifice measured nearly 9 centimeters. (In Bouveret's third case 8 centimeters.) In the last-mentioned case there was some atrophy of the kidneys (115 and 110 grammes) with increased arterial tension, and to this cause Bouveret refers the dilatation of the aortic orifice.

Yet as regards the occurrence of relative aortic insufficiency of this type there are some doubters, e. g., Friedreich,[22] Rosenstein,[23] Peter[24] and Potain.[25]

For the water test, on which many authors rely for proof of aortic insufficiency, is, of course, not regarded as final by modern pathologists, and furthermore, few of the writers who describe relative aortic insufficiency secondary to a sclerosed and dilated aorta have described the aortic valves as *entirely* sound. Experimentally it has been found very difficult to produce any considerable dilatation of the tough aortic ring even by exerting upon it a pressure much higher than that occurring in arterio-sclerosis and chronic nephritis.

II. *Diastolic Murmurs Associated with Intense Anæmia.*

Gerhardt,[26] Scheube,[27] O. Vierordt,[28] H. Vierordt,[29] Eichhorst,[30] and others, mention "accidental" or "anæmic" diastolic murmurs as possible, but very rare.

Litten (Deut. med. Woch., Feb. 24, 1885) refers very briefly to the occurrence of diastolic murmurs in "anæmic, poorly nourished" women, the murmurs being independent of any demonstrable lesion of the heart or aorta, and not due to venous murmurs transmitted down from the neck.

Klein[34] reports a case of extreme anæmia in a girl suffering from chronic Bright's disease. In the "aortic area" there was heard a diastolic murmur following the second sound, and the diagnosis of aortic regurgitation was made. At autopsy the valves were normal, the aorta not dilated, the lungs normal.

V. Noorden[35] records "presystolic" (not diastolic) murmurs in 2 cases of intense anæmia with no valvular lesions post mortem. A similar case has been observed by one of us.

Sahli,[36] in discussion of what he calls "Functional diastolic heart murmurs," concludes that when blood pressure is high, there may be enough dilatation (temporary or permanent) at the aortic and pulmonary orifices to prevent the closure of these valves.

He also discusses and exemplifies what he calls "accidental diastolic heart murmurs" in two cases of grave anæmia (red cells 720,000 and 796,000) precisely like some of those which we shall report below. In these cases no dilatation of the aorta could be made out post mortem and the valves were intact, but the left ventricle was in both cases dilated. The diastolic murmur appeared for the first time a few days before death. These murmurs, Sahli believes, to be independent, not only of any valvular lesion, but of any temporary stretching of the aortic orifice, for such a dilatation must depend (according to him) upon high blood pressure in the great arteries, while in the two cases mentioned the pressure appears to be notably low. Sahli believes that the murmurs were due in these cases to the extreme thinness of the blood.

In both cases there were also present venous murmurs in the neck, but their pitch, duration and point of maximum intensity were quite different from those of the murmurs in ques-

tion, and between the two points of maximum intensity there was a zone free from any adventitious sound whatever.

III. *Cardio-Respiratory Diastolic Murmurs.*

No attempt has been made to collect all the literature of this phase of our subject, but examples of German, French, English and American writings are subjoined.

Friedreich [4] mentions as a great rarity a case of phthisis "with anæmia" in which during life he heard a musical diastolic murmur over the left ventricle. There was found bilateral pulmonary tuberculosis post mortem and the conditions seem to have been favorable for the production of cardio-respiratory murmurs, though Friedreich suggests no such explanation.

Weiss [32] reports three cases with diastolic murmurs along the left border of the sternum, loudest in the third, fourth and fifth spaces respectively. No anæmia and no dilatation of the aorta is mentioned, but in all three cases there was extensive pulmonary tuberculosis. It seems possible that the murmurs may have been of the cardio-respiratory type, but they persisted in all phases of natural, forced and arrested breathing. There were no murmurs audible in the neck-veins.

Potain [33] reports three cases apparently similar to the above, but without autopsy, one case with autopsy at which tuberculosis of the peritoneum, lung and pleura was found, and another with autopsy and no tuberculosis. In one of the cases without autopsy the murmur disappeared when the patient sat up.

Drummond [37] records two cases of phthisis with diastolic murmurs disappearing on holding the breath.

Hoover [35] says in discussing cardio-respiratory murmurs that they "rarely accompany sharply the diastolic tone, but more often directly follow it." He describes two cases, in one of which there occurred a diastolic murmur audible at first in the second right intercostal space and at the apex, but later over the whole præcordia. The heart was dilated and insufficient. The murmur persisted in all the phases of natural and forced respiration and could not be made to disappear by changing the position of the patient. There were no sounds audible over the jugular veins nor over the bulbus venosus. Hence, Hoover made the diagnosis of aortic regurgitation, but "the autopsy revealed not the slightest sign of an endocarditis at any point, nor were there any evidences of dilatation of the aorta or of the aortic ring."

In Hoover's second case the diastolic murmur was in the pulmonary area and could be made to disappear on forced expiration.

In the first case then there was nothing adduced as evidence to show that the murmur was of cardio-respiratory origin, and we are inclined to believe that it was of the same nature as one of those which we have ourselves observed.

Discussion of the Writers' Cases in the Light of those Previously Reported.

The first of our cases very possibly belongs to the group of those in which the diastolic murmur is supposed by most writers to be due to a genuine regurgitation at the aortic orifice resulting from dilatation of the ring into which the valves are inserted.

The other three cases appear to belong to the class of diastolic murmurs studied especially by Sahli,[36] and supposed by him to be due to the *intense anæmia* present in his cases as in ours.

Two explanations of these murmurs seem most plausible:

1. That of Sahli, that they result in some way from the extreme thinness of the blood.

2. That they are due to a *temporary* elastic stretching of the aorta, relieved when the heart ceases to beat, and therefore not demonstrable post mortem.

Against the second of these explanations Sahli urges the powerful objection that the blood pressure in his cases was very low and that high blood pressures would be necessary to produce any stretching of the aortic ring. Low blood pressure was present in two of our three anæmic cases; in the third, owing to a chronic glomerulo-nephritis the blood pressure was high and might conceivably have stretched the aortic ring, especially as the aorta was unusually thin and elastic in this, as in so many cases of intense anæmia.

For the other two cases we have no better explanation than Sahli's to offer (extreme thinning of the blood), though this does not seem to us by any means a satisfactory one. There was no venous hum in any of our cases, nor was any marked change produced in the murmurs by changes of position or by the different phases of respiration.

Details of our cases follow:

Case I.—James Coleman, a barber of 50, entered the Long Island Hospital July 9, 1900. His family history and past history are not significant. He had used whisky to excess for 20 years. His present complaint is of dyspnœa, muscular weakness, and swelling of the feet, symptoms which first showed themselves three months ago and compelled him to give up work two months ago.

Physical Examination.—The heart's impulse, which was diffuse, could be seen and felt and extended half an inch beyond the nipple in the fifth interspace. The right border extended half an inch beyond the right edge of the sternum. The action was very irregular. A soft systolic murmur limited to the region of the apex beat and another systolic murmur at the second right interspace were easily audible, the latter only after exertion.

In the 3d and 4th intercostal spaces just to the left of the sternum, a diastolic murmur was heard.

The pulse was of low tension, irregular and intermittent. Visible pulsation was noted in all the superficial arteries. Moderate œdema of the lower legs. All the superficial arteries were tortuous, stiff and uneven of surface. At the base

of each lung behind there were a few crackling râles. Physical examination was otherwise negative.

Blood showed red corpuscles 4,200,000; white corpuscles, 5600. Urine, high in color, acid, 1020, ⅛ per cent alb., no bile or sugar. The sediment contained a little abnormal blood and a few hyaline granular casts.

The patient lived but six days after entering the hospital and did not react at all to treatment. The clinical diagnosis ante mortem was aortic regurgitation, mitral regurgitation, myocarditis, chronic interstitial nephritis.

Autopsy.—July 21, 1900. Was performed by Dr. Geo. B. Magrath, and may be summarized as follows:

Heart hypertrophied; weight 480 grams; wall of left ventricle 20 mm. in thickness. The valves and cavities normal. The aortic valve 8 cm. in circumference, the others within normal limits. Coronary arteries present a moderate degree of arterio-sclerosis.

Pleural cavities both partially obliterated by old fibrous adhesions. Lungs show considerable œdema and congestion. Peritoneal cavity contains about a pint of turbid straw-colored fluid.

Kidneys combined weight 260 grams. Capsule strips with some difficulty, leaving a roughened surface. Cortex .3 cm. in thickness; markings fairly distinct. The other organs presented nothing markedly abnormal.

Case II.—Mrs. Tuttle, 20 years old (married), had scarlet fever in childhood, but apparently recovered her health and remained well until 1899, when she had an attack of "rheumatism around the heart." Had a miscarriage about this time, but has never had a living child.

Three weeks before entrance, dyspnœa, orthopnœa, cough with blood-streaked sputa and œdema of legs and face began to distress her and for relief of these symptoms she entered the Samaritan Hospital Sept. 21, 1901, in the service of Dr. E. P. Joslin, who has very kindly allowed us to use the case.

Examination showed a very small and pale woman (weight 90 lbs.), with orthopnœa and a pulse of 132, of small volume and low tension. The heart's apex in the 5th interspace, 5 cm. outside the nipple. There was a systolic murmur and thrill most marked in the third left interspace outside the nipple, but also noticed over the whole præcordia and in the left axilla. Slight œdema of extremities and of the bases of the lung.

Blood: Red cells 2,860,000, hæmoglobin 20 per cent.

Urine: 450 cc. in 24 hours. Sp. gravity 1011. A large trace of albumen; rare hyaline and granular casts.

Sept. 27.—Loud blowing diastolic murmur in the 4th left interspace. Presystolic thrill and rolling presystolic murmur in the second and third left interspaces. The first sound at the apex very sharp, the second sound there also loud and ringing, as was the aortic second.

The patient was seen Oct. 13 by one of us who made the following record: "Most comfortable in a semi-reclining position. A space the size of the palm in the region of the left nipple rises with each systole. The apex beat extends 2 inches beyond the center of the nipple in the fifth space.

"Cardio-hepatic angle (by percussion) acute. Cardiac dullness 2½ cm. beyond the right sternal margin.

"Both sounds at apex clear and strong, the second accompanied and followed by a short, high-pitched murmur occupying the first two-thirds of diastole and heard loudest over the 4th and 5th left costal cartilages. Pulmonary second sound accentuated and reduplicated. In this area the diastolic murmur has at times a musical quality. Aortic second weaker than normal.

"Pulse regular; 120; the wave rather sharp at the summit and collapsing somewhat more rapidly than normal, but it is *difficult to compress it.*

"Bubbling râles at the base of both lungs."

Urine 1460 cc. in 24 hours; 1009 in sp. gravity; albumen ⅛ per cent; no casts. Red cells 3,308,000. Hæmoglobin 40 per cent.

Nov. 2.—Tic-tac rhythm; systolic tricuspid murmur; no diastolic murmur heard. Right border reaches half way to right nipple (percussion).

Nov. 14.—Apex in anterior axillary line. Diastolic murmur faint, but unmistakable. Second sounds at base strong. Slight ascites.

Urine 840 cc.; albumen ⅛ per cent. Few hyaline and granular casts.

Died November 18.

Autopsy (Dr. J. H. Wright).—Heart showed no valvular lesion. Marked hypertrophy and dilatation (weight 525 grams). Aortic valve 5½ cm. in circumference.

Kidneys: Combined weight 68 grams; 7.3 and 7.6 cm. in length. Microscopically they showed the lesions of chronic glomerulo-nephritis.

The other organs not remarkable.

Case III.—Annie McDonald, a married woman of 34, entered the Massachusetts General Hospital February 6, 1902. Nothing of importance in the family history or past history of the patient, except that she had used alcohol to excess. For two years she has been troubled with œdema of the legs, and frequent nose-bleed. For a year dyspnœa, palpitation, extreme weakness and pallor. For three months her face has been puffy in the morning and she has had to pass urine several times every night. The nose-bleed above referred to came at first every week and often lasted five or six hours.

Three weeks ago she was delivered at the Lying-in Hospital of a full-term child, after a normal labor. Following it she has had a series of very profuse uterine hemorrhages, resulting in extreme anæmia and prostration. At the time of entrance the patient had scarcely strength to lift her hands, was at times delirious and had been vomiting so persistently that rectal feeding had to be adopted.

Physical Examination.—Skin very pale yellow; no emaciation. By percussion and palpation the heart's impulse was found to extend 16 cm. from the mid-sternal line in the fifth intercostal space. No enlargement could be made out to the

right. Action strong and regular, impulse heaving. Over the whole præcordia, but with greatest intensity over the 3d and 4th left costal cartilages, a blowing, diastolic murmur was heard. Systolic murmurs were heard in the aortic area and at the apex, the former transmitted to the neck, the latter transmitted to the axilla and to all parts of the front of the chest. Over a small area near the apex impulse in the nipple line was a well-marked palpable thrill and presystolic rolling murmur. Pulmonic second accentuated, aortic second scarcely audible. The pulses equal, synchronous, of large volume and low tension ("Corrigan pulse"). Capillary pulse not visible. No abnormal sounds in peripheral arteries. Lungs and other organs negative.

Red corpuscles, 840,800; white corpuscles, 6300; hæmoglobin, 15 per cent. Differential count of 400 white cells showed: polynuclears, 57 per cent; lymphocytes, 42 per cent; eosinophiles, 1 per cent. While counting these, 6 normoblasts and two megaloblasts were seen. There was moderate poikilocytosis with slight achromia and a tendency to small size.

Urine: pale, acid, 1014, alb. sl. poss. tr., no bile or sugar, urea, 1.39 per cent. Sediment: many fatty renal cells, occasional hyaline and finely granular casts with fat and renal cells adherent.

Patient failed rapidly and died in three days.

Autopsy, Feb. 9 (Dr. J. H. Wright), showed, scattered over the face, neck and trunk and extremities, a number of purplish red spots, largest about 3 mm. in diameter. About 200 cc. of serous fluid in pericardium. Ecchymoses in epicardium of both ventricles. Heart of normal size, weight 338 grams, valves and cavities normal. The myocardium firm, brownish, the papillary muscles covered with a fine yellowish mottling. Microscopical examination of a teased preparation from the myocardium of the left ventricle showed a moderate amount of fatty degeneration of the muscle fibers. Kidneys: combined weight 294 grams. Capsules not adherent. Cortices of normal width and showing the normal markings. Substance of kidneys more resistant to touch than normal. Pale, brownish gray in color and rather translucent.

Microscopical examination of a frozen section shows degeneration of many tubules.

The uterus almost filled with a mass of clotted blood. The mucous membrane of the stomach showed a moderate number of scattered red points and a thin linear cicatrix about 2½ cm. long near the lesser curvature.

The marrow of several vertebræ and of the shaft of the femur was for the most part yellow, and apparently fatty. The other organs showed nothing remarkable. Cultures negative.

Case IV.—John W. Cole, sea-captain of 56, entered the Massachusetts General Hospital December 21, 1901. There was nothing remarkable about his family history, past history or habits. He entered the hospital on account of increasing dyspnœa, muscular weakness and pallor, symptoms which have been noticed for about four months. A little puffiness of the face and ankles has been noticed at times. He is thirsty but has little appetite and his food feels heavy in his stomach two or three hours after meals. He has had no nausea or vomiting. He has lost no flesh and had worked until he entered the hospital.

Physical Examination.—A well-nourished man with a pale lemon-yellow colored skin. The heart's impulse was palpable in the 5th space 12 cm. from the mid-sternal line. No enlargement to the right. The action was regular and of fair force. Along the left edge of the sternum was a faint blowing murmur occupying the whole of diastole. In the aortic and mitral areas there were soft systolic murmurs transmitted respectively to the neck and to the axilla. Pulmonic second slightly accentuated. Radials palpable, pulses synchronous, slightly irregular and poorly sustained, but not of the "Corrigan" type. No capillary pulse no abnormal sounds in the peripheral arteries.

Moderate œdema of the lower back, of the thighs, legs and genitals. Examination of the eye ground by Dr. Cheney showed retinal hemorrhages.

Red corpuscles, 904,000; white corpuscles, 5000; hæmoglobin, 25 per cent. Differential count of 400 cells showed: polynuclears, 65.2 per cent; lymphocytes, 34.8 per cent; eosinophiles, 0. While counting these, 6 megaloblasts and 2 normoblasts were seen. There was marked poikilocytosis with predominance of macrocytes and slight polychromatophilia.

Urine: normal color, acid, 1016, alb. sl. poss. tr., bile absent. Urea: 36 grams in 24 hours. Sediment not pathological.

The patient gradually failed from week to week and with the advance of the disease the diastolic murmur disappeared. The other murmurs persisted. There was no other change of any importance either in the blood or in any of the other signs. Death occurred the 29th of March.

Autopsy, March 30, 1902 (Dr. J. H. Wright), showed a large accumulation of fluid in each of the serous cavities and in the subcutaneous tissue. The heart weighed 370 grams; the wall of the left ventricle 12 mm. thick. Valves and cavities not remarkable. A moderate amount of fatty degeneration of the myocardium was shown on microscopic examination.

Kidneys combined weight 362 grams, capsule not adherent. Cortices of normal width and their markings normal. Consistency of the organ increased markedly and on section the tissue has a flint-colored appearance.

The mucous membrane of the stomach showed numerous red spots and points.

The marrow of the sternum of several vertebræ and of the shaft of the femur is transformed into a dark red, fleshy, friable, moist material. The other organs showed nothing of importance and cultures from the heart, liver and spleen showed no evidence of general infection.

Summary and Conclusions.

1. Diastolic murmurs without organic valve lesions are not uncommon in connection with dilatation of the aorta, localized or diffused. One of our cases seems to be of this type.

2. When the pleura and pericardium are adherent, owing to tuberculosis or other causes, diastolic murmurs are occasionally audible in the præcordia. Such murmurs are notably affected by respiration and by position; they are probably due, in most cases, to suction or pulsion exerted by the heart upon portions of lung adherent to the pericardium ("cardio-respiratory murmurs").

3. In cases of intense anæmia, when the red cells are reduced to or below 1,000,000 per cu. mm., one occasionally hears diastolic murmurs not to be explained by permanent dilatation of the aortic ring nor as "cardio-respiratory murmurs," and not due to a diastolic accentuation of a venous hum.

The cause of these murmurs is obscure.

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THE USE OF THE X-RAY IN SURGERY.[1]

By E. A. Codman, M. D., Boston.

Since I began practice in December, 1895, most of my experience has been obtained in the surgical wards of the Massachusetts General Hospital. It happened that in the very month in which I started practice the discovery of the X-ray was announced and within a few months I began using it. I took it up because it seemed to me likely to become a valuable aid in surgery and for the same reason I have followed its development since. What I am to say to you to-night, therefore, I trust you will take as from a surgeon rather than from an X-ray specialist. I hope that it is because I am a surgeon that I have the honor of speaking to you on the X-ray.

At the Massachusetts Hospital the X-ray is in daily, almost constant use. We are fortunate in having a skiagrapher whose sound sense and intelligent interpretation of the plates has made his opinion valuable. It is a significant tribute to the worth of the X-ray in diagnosis to see, that though this skiagrapher has no medical education as such, he is almost daily called upon to make diagnoses of the various forms of fracture or to differentiate between tubercular and syphilitic diseases of the bone, osteomyelitis and sarcoma. Probably our experience of the X-ray has been much the same as yours. I may sum it up thus: many disappointments, occasional successes, great hopes for the future. We find it especially useful in the diagnosis of fractures and bone diseases, in the localization of foreign bodies and concretions, and in the treatment of epithelioma, psoriasis and eczema.

[1] Read before the Johns Hopkins Medical Society, February 2, 1903.

Occasionally it enables us to demonstrate a suspected aneurism or to determine the exact size and position of the heart, but it is not yet of much practical value in the diagnosis of thoracic diseases.

I have seen trouble caused by searching for foreign bodies which the X-ray showed very nicely. I remember a bullet in the brain which was diligently searched for. Shortly afterwards at autopsy it was found just beneath the dura. I remember a stone in the kidney which proved to be a button on the back of a nightgown. A few years ago interesting children coming to the accident room with pennies in their stomachs were admitted to the hospital; now they are allowed to pass the pennies at their homes. Occasionally, however, it is strikingly useful. In one case I remember rescuing a child from a brilliant œsophagotomy by extracting a cent impacted in the portion of the œsophagus just behind the intersternal notch. By looking with the fluoroscope I was able to see the jaws of the forceps open and close over the coin. I am satisfied that in small children coins impacted in the œsophagus can generally be removed in this way or dislodged. Incidentally I cannot speak too highly of Dr. Coolidge's method of locating and removing foreign bodies impacted in the bronchi by introducing a urethroscope through a tracheotomy wound.

We use the X-ray as a routine method in fractures. I am personally thankful that my house officer experience was in the days before the X-ray. Our house officer of to-day must leave the diagnosis to the skiagrapher. It is not fair to the patient to learn fracture pathology in the old way. I do think, however, that our greatest help from the X-ray in fractures is in learning more accurately their pathology. We see now so many skiagraphs that we jump from the look of the broken limb to the probable position and cleavage of the fragments. Thus, before the X-ray is taken, I find myself making correct clinical diagnoses of fracture of the carpal scaphoid, of the os calcis, and of certain fissures of the external malleolus, which in the old days were classed as sprains. Fractures are set better now than they were in my day. This is especially noticeable in Colles fractures.

In the detection of stones in the kidney and ureters we have been disappointed. As yet we have not been able to keep the routine standard of excellence of the plates to a point clear enough to say positively "yes" or "no." "Yes" we can say occasionally, "no" rarely. On two occasions I have failed to locate in stout people small renal stones, which were later removed. Unless the patient is decidedly thin I should not have confidence in a negative diagnosis. I believe that the question of operation in such cases should be decided by the gravity of the symptoms or by a positive skiagraph which has been several times repeated. In the localization of ureteral stones the X-ray is especially helpful. Dr. J. W. Elliott had a brilliant case at the hospital in which a ureteral stone was located and easily and successfully removed.

Of all the cases which attend our clinic none seem so willing to keep their appointments, to wait patiently for hours, or to show themselves as those which are waiting for X-ray treatment. Perhaps there are still among you skeptics who doubt the efficiency of the X-ray as a therapeutic agent. Two years ago I was a skeptic myself and went out of my way to find philosophical and psychical excuses to explain the zeal of patients to return for treatment. I confess I cannot wholly rid myself of these excuses yet, but I have now seen some successes so brilliant that I cannot wonder that they arouse hope in the hopeless and that the poor wretch with recurrent cancer of the jaw fancies that faithful attendance on the X-ray machine will cure him as it has the man who sat next him with epithelioma of the nose.

The therapeutic X-ray work at the hospital is at present mainly done by Mr. Dodd and Dr. Vose, who are working on malignant disease for the Cancer Commission, and by Dr. Burns, who does the routine work of the skin department. Since their work will undoubtedly some day be reported in full, I will merely make a few general observations.

Though many cases of deep malignant disease have been faithfully exposed, few have essentially improved and none have been cured. There have been a few encouraging signs in some cases as relief from pain, gain in weight, shrinkage, softening, breaking down of the tumor, etc., but since these events occur in the course of untreated malignant disease the positive advantage of the X-ray can hardly be proved. On the other side, cases of epithelioma are brilliant. About a hundred have healed or are healing. Occasionally one is referred to the surgical department for excision. I am sorry to say that the present enthusiasm sends the case to the X-ray first, for I still believe that in most cases there is no Indian so good as a dead Indian. The responsibility of removal should remain with the surgeon, and he should refer it to the X-ray when contraindications to operation exist. Leaving you to look forward to the reports of Dr. Vose and Dr. Burns, I will briefly take up the more interesting of my private cases, for I do no X-ray work personally at the hospital.

Dr. J. C. Warren operated on an unusually hopeful case of cancer of the tongue in April, 1902. As far as could be seen the disease was entirely removed and the wounds healed well. I began the X-ray in May for prophylaxis and kept the floor of the mouth and sides of the neck of the patient on the edge of troublesome dermatitis until September, by which time the disease had so far recurred in the mouth and neck as to make the X-ray a mere nuisance.

Since October 4 I have treated a case of cancer of the breast, which for certain reasons had never been operated upon. I have kept the skin constantly exfoliating and at times blistered. The growth remains, so far as I can tell, practically the same.

Note 1.—This remains true on April 14, 1903.

In a breast case operated on by Dr. A. T. Cabot in October, 1901, there were seven spots of cutaneous recurrence on December 4, 1902, about the size of lemon seeds. These were in

the skin rather than below the skin, but were not ulcerated. At the present date five have entirely disappeared and two can only with doubt be recognized. I do not mention this case as even benefited, because of course with seven skin recurrences the disease must also have recurred in the deeper tissues. I merely want to say that in some cases it is possible to remove by the X-ray the recurrent skin nodules.

Note 2.—All seven spots have disappeared and have not returned. April 14, 1903.

I have exposed without success two cases of cancer of the penis. On one case the cancer was but a quarter of an inch in diameter, but was so obstinate to X-ray treatment that an amputation was done, as there were other smaller areas of a similar nature on the glans. Possibly with more persistent and vigorous treatment I should have succeeded better. The sections from this case are shown in Figs. 1 and 2.

If I had come to speak to you in October I should have said that the only cases of malignant disease in which I had seen unequivocal improvement from treatment with the X-ray were those of epithelioma and superficial post-operative recurrence. A year ago in an article on X-ray burns I stated that there was no good evidence that the deeper tissues were affected unless the skin overlying them also was injured. I should have used this as an *à priori* argument against probable improvement in subcutaneous malignant disease.

Since then, however, I have had a case which you may take as the exception which proves the rule. On November 10, 1902, Dr. J. C. Warren referred to me a patient with sarcoma of the sterno-clavicular region on whom he had just operated. A small incision had been made and a piece of the growth removed and found by Dr. Whitney to be a round-celled sarcoma.[2] The tumor proved to be inoperable and within a short time I began the X-ray treatment. At that time the tumor was 5 x 2½ inches. At this date it cannot be measured, for nothing remains but a slight thickening about and behind the clavicle. The weak point of this case is that when the tumor subsided a subluxation of the clavicle was revealed. This fact suggests that the periosteum may have been torn and have formed a callous. Then too, I have seen at the hospital other cases of sarcoma faithfully followed by the X-ray and yet steadily grow worse.

I wish I could take the time to tell you of other cases—one of two small areas of facial lupus which after six months' fight aided by curetting finally healed, only to recur again in two months; cases of psoriasis and of chronic eczema which have faded away as if by magic, and yet have recurred in other places; and two of interesting, though sad, cases of lympho-sarcoma.

In speaking of X-ray therapeutics I have purposely avoided quotations from the writings of others, believing that what you want from me are merely the things I can swear to. You have read, as I have, certain rosy articles on the use of the X-ray in the more terrible forms of malignant disease, of the disappearance of sarcoma and cancer, but all I can tell you is that at the Massachusetts Hospital we do not get such good results and in my private practice I do not get such results. I have put my best foot foremost and told you of the most wonderful cases I have had, and later I will show you a lantern slide of the most successful hospital case.

However, I am ready to stand here and say to you that the effect of the X-ray in causing the disappearance of psoriasis, chronic eczema, lupus and superficial epithelioma is little short of the miraculous. In some cases I know that recurrence takes place, perhaps after too brief treatment. I believe, too, that though few reliable reports of success in deep cancer and sarcoma have yet appeared, considering the immense number of such cases which have been treated, the X-ray offers at least some hope and deserves an attention and dignity which has not yet been accorded it by the best of the profession.

I know that some of you will ask for a plausible theory of the action of X-rays. In answering this I will relax the strong effort I have made to stick to facts. It seems to me that the effects are due to stimulation of the nutrition of the parts rather than to destruction of the malignant tissue, because:

1. The effect often does not take place for days and sometimes for weeks.

2. From the analogy of so-called burns the primary effect is increased stimulation of the skin as evidenced by hyperæmia and exfoliation.

3. In one case of massive malignant disease of the breast which had been long and faithfully exposed no destruction of the cells was found. Degeneration in the interior of such cancers which have not been treated is often found.

4. The appearance sometimes found of shrunken cancer cells surrounded by granulation tissue may be explained by the activity of the tissue.

5. In a case of varicose eczema of the leg which I treated the eczema not only disappeared but the leg shrank to its normal size and its circulation became active.

6. The good effects occur chiefly in those diseases which are characterized by a disordered or indolent local nutrition, which nature when stimulated by other means has at least a chance of throwing off. For instance we all know that chronic eczema, psoriasis, lupus, rodent ulcer, epithelioma, even ulcerated cancer of the breast, may under improved conditions heal in whole or in part. Even in deep-seated

[2] At the operation on Mr. B at St. Margaret's Hospital, October 24, (S. 210-2), there was seen a diffused, infiltrating new growth over the clavicle which had grown into the muscle. The growth was white and fasciculated and to the eye presented the characteristics of a sarcoma.

Microscopic examination of the small fragment which was removed showed small, round cells in solid masses among which were occasional muscular fibres more or less degenerated, and widely separated from each other by the new growth. The cells of the new growth seemed to have a little rather homogeneous, and, in places fibrillated, tissue between them, and were traversed by very numerous, small blood vessels with distinct walls. Among the cells there were very numerous mitoses.

The structure of the growth confirms the diagnosis of sarcoma, and the type of cells places it in the round cell variety.

W. T. WHITNEY.



FIG. 1.

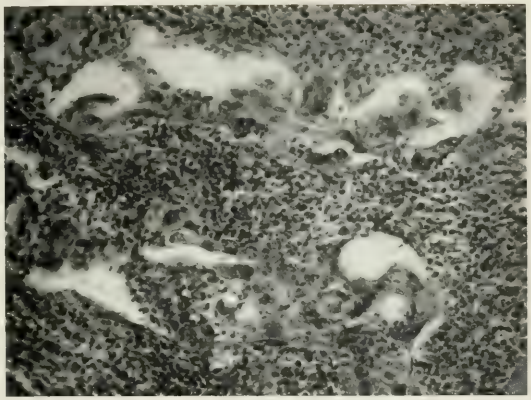


FIG. 2.

Sections taken from a case of cancer of the penis in which there were several distinct lesions, one of which had been treated much more vigorously than the others.

FIG. 1 was taken from a relatively untreated lesion and serves to show the type of cancer.

FIG. 2 was taken from the lesion which had been most treated and serves to illustrate the replacement of cancer cells by a granulation-like tissue.

Kindness of Dr. J. H. Wright.



FIG. 3.



FIG. 4.

A case of recurrent cancer of the breast before and after the use of the X-rays to illustrate the fact that though healing of a large part of the ulcerated portion has taken place, the subcutaneous growth in other places has continued to advance.

Kindness of Mr. Walter Dodd.

malignant disease we may find cases of spontaneous absorption of sarcoma, perhaps coincident with some outlandish treatment.

7. That of the above mentioned forms of disease nature is more likely to help in those in which the X-ray is most efficacious, while in cases where the malignancy of the cancer growth is great even the X-ray cannot check it.

8. That good and bad effects alike occur chiefly in the skin, the nutrition of which seems in a more delicate balance than that of the deeper tissues.

I mention my choice of aiding nutrition rather than causing destruction because our choice indicates our rationale of treatment. With any modern X-ray apparatus it is possible to cause necrosis of the tissues by decreasing the distance of the tube and prolonging the time of exposure. If we are doing good by destroying abnormal tissue we want to give large doses. If we aim to stimulate we should limit our doses to their physiological effects.

My method is to expose for ten minutes at ten inches as a standard dose. To repeat this twice a week until hyperæmia appears or we reach the end of the third week. By this means, the accumulated dose at the end of the third week only reaches 60 minutes at 10 inches. Then, if necessary, to increase it, never allowing a burn of the second degree if it can be avoided, but keeping the parts hyperæmic, pigmented or exfoliating.

Since other conditions being the same the intensity varies inversely as the square of the distance from the anode, we may reduce all exposures to this unit dose by using the formula:

$$\frac{T}{D^2} \times 100 = \text{the equivalent time at a distance of 10 inches.}$$

This, of course, implies keeping the tube at a high degree of efficiency, which for most good apparatuses does not greatly differ. In most individuals slight dermatitis usually appears in from two to three weeks with my apparatus, a Kinraide coil. In one case I caused a slight dermatitis by an exposure equivalent to 15 minutes, but usually it requires 40 to 100 minutes at ten inches in added exposures. Before reaching this point psoriasis and eczema may disappear, but in my experience the tide turns in epithelioma at about the same time as dermatitis appears. To cases which do not show at least slight improvement in six weeks I should give a bad prognosis. I do not believe that it is yet justifiable to use the destructive power of X-ray to cause necrosis in the manner of the old-fashioned cancer pastes, etc. The choice between such an X-ray burn and cancer is too terrible.

Finally let us remember that cancer may arise in an X-ray burn. Two such instances are on record already and one sad case has recently occurred in Boston. Cancer appeared simultaneously in the ring fingers of both hands, necessitating amputation at the first phalanges. The hands had been in a chronic state of ulceration from an X-ray burn for several years.

What information can we expect from the X-ray in cases of bone disease? This question may be partially answered *à priori* from a study of the physics of the X-ray. We cannot expect it to tell us the odor, color, sensitiveness, pain, temperature of the affected limb. No more can we expect it to give us a picture of the surface of the affected bone or of its cross or sagittal section. A skiagraph is a chart of the relative densities of the different portions of an object. More exactly it is a chart of the relative densities of substances encountered by the X-rays in their direct paths from the focal point on the anode to the photographic plate. The opacity of a substance to the X-ray varies directly with its atomic weight. Most errors in X-ray interpretation are made by looking at the skiagraph as at a cross section or as at a surface picture like a photograph. The outline is often the same, but in the skiagraph it bounds a chart of densities; in the photograph merely a picture of the surface. Therefore let us put it roughly, "Don't find fault with a skiagraph because it doesn't tell you how a bone smells."

What is the reason that pictures of the bones of the trunk in stout people are less satisfactory than of the limbs? Probably there is a little diffusion of X-ray light, but the main reason is that there is but a slight difference between the density of the total amount of substance encountered by the rays that only go through soft parts and those which go through both soft parts and bone. The contrast will stand in nearly the same ratio as the weights of equal columns of flesh to one of which a pinch of bone salts has been added. This is further complicated by other technical details as the nearness of the bone to the plate, the distance of the tube, etc. In some cases the contrast is so slight that we get no detail whatever and we must be content with merely knowing whether the bone is affected at all. In clearer pictures we may draw more complicated conclusions, e. g., that loss of substance has occurred, that new bone has been formed, that an old area of disease has become surrounded by new bone, that cavities in the bone exist, that sequestra have become isolated, and the like.

In fact we may infer with great exactness what the true pathological anatomy of the bone itself is, if we consider only the inorganic constituents of the bone. We may infer what its appearance would be if made into a dried museum specimen. But when we begin to infer the description of the organic elements we begin to make our mistakes. When we prophesy the contents of a cavity in the bone we must choose between many different forms of tissue with small atomic weight. Its contents may be cystic fluid, cartilage, pus, sarcoma, carcinoma, myeloma, gumma, osteoid tissue, tubercular granulations, or what not. In the same way cortical hypertrophy may be due to the poisons of phosphorus, syphilis, typhoid, tuberculosis, acromegaly, Paget's disease, osteo-arthropathie pneumonique and other conditions. Fortunately, however, there are often in skiagraphs certain finer details which may point more or less definitely to which one of these conditions has caused the formation of cavities or cortical thickening. For example the bone blisters in typhoid, syphilis and leprosy are not found in other diseases causing

cortical enlargement. Bone abscesses, gumma, periosteal sarcoma usually show the appearance of a cavity with thick walls, while myelogenous sarcoma, myeloma, bone cysts and carcinoma show an apparent cavity with thin walls.

As another instance some of the following points might aid us in the diagnosis of a diseased leg.

In syphilis increase of new bone is the rule; in tuberculosis destruction of old healthy bone. Syphilis rarely causes the formation of a sequestrum. Tubercular sequestra are always small and poorly defined. The sequestra of osteomyelitis are generally large, well defined and resemble the cortex of the old bone. Tuberculosis almost always starts in the epiphyses and is very rare in the shaft. Syphilis is almost always in the shaft and extremely rare in the epiphysis. Cortical thickening in syphilis is often very symmetrical, while in osteomyelitis it is irregular and fantastic. In syphilis the other unsuspected long bones usually show cortical enlargement, while in osteomyelitis only one bone is the rule.

Instead of confusing you with further descriptions, however, I will show you some lantern slides, for after all practice in the interpretation of the plates is the main thing.

Discussion.

Dr. Bloodgood.—Dr. Codman has left one very little to say except to thank him for the delightful and interesting discussion of the value of the X-ray in diagnosis and treatment.

In regard to the X-ray treatment of superficial epithelioma of the skin we have but one specimen in the surgical laboratory, which previous to its excision had been treated for some months with a Röntgen ray. Clinically the tumor was situated on the right side of the lower lip, and was about 8 x 5 mm. in diameter; it was considered to be an epithelioma. It had been present a number of months previous to the use of the X-ray. The X-ray treatment was followed for six or eight months and then discontinued. Clinically very little change was observed in the tumor. It surely did not get any larger, perhaps it got a little smaller. The tumor consisted of a small area of superficial induration at the muco-cutaneous border of the lower lip, and at one point on the mucous membrane side there was a superficial ulceration. The duration of growth from onset to the time of excision was about two years.

I was not informed of the date of the last X-ray exposure, but it was within at least four months of the time of the excision of the tumor. The tumor was removed by Dr. Finney and sent to the laboratory. It consisted of a V-shaped piece of tissue about 1.5 cm. in diameter, surrounding a small, rather circumscribed tumor at the muco-cutaneous border of the lip. On making one gross section the usual naked eye appearance of a squamous epithelioma was not definitely present. The tissues looked more finely granular, and one did not see the definite dots and lines, white in color, which in the majority of epithelioma can easily be seen, and are due to large alveoli of large squamous epithelial cells.

The first section cut and stained showed a very interesting histological picture; one could see normal skin to either side of the section, between this and extending into the deeper tissue there was a zone of tissue resembling granulation tissue. This zone of granulation tissue was not covered by normal epidermis, but by a layer two to three cells thick, of large epithelial cells. In the granulation tissue beneath this thin epithelial layer one could not recognize definitely any epithelial cells. This section therefore seemed to demonstrate what Dr. Codman has said, that the X-ray stimulates the formation of granulation tissue, and that this granulation tissue in its growth destroys the nest of epithelial cells.

February 10, 1903: Since discussing this section before the Medical Society further sections of the tumor have been cut and stained. These sections differ from the one described in that they show a definite squamous cell epithelioma. The sections, however, differ from the ordinary epithelioma in the great amount of granulation tissue between the epithelial alveoli. The first section seemed to demonstrate that perhaps the most of the epithelial alveoli had been destroyed, but further sections demonstrate that as yet the majority of the little tumor is a definite squamous cell epithelioma.

TRAUMATIC PERICARDITIS, ENDOCARDITIS AND MYOCARDITIS.

By J. Hall Pleasants, M. D., *Assistant in Medicine, Johns Hopkins University.*

While trauma as an occasional cause of cardiac disease is vaguely referred to in several text-books on medicine and surgery, the part which it may play in the production of pericarditis, endocarditis and myocarditis is not very generally appreciated. It should be understood that reference is here made not to direct injuries of the heart and its membranes by perforating wounds of the chest, but to the more indirect effect upon the heart and pericardium of contusions over the præcordia or elsewhere upon the thorax, or even as the result of concussion from severe blows upon distant parts of the body. Scattered throughout the literature several such cases have been reported. Two cases of pericarditis and one case of endocarditis, which have recently come to my attention, are of sufficient interest in this connection to report. The causal relation of trauma to these three cases seems unquestionable. In one of the cases of pericarditis there was also infarction of the myocardium, probably of traumatic origin.

Traumatic Pericarditis.

Case I.—July 7, 1902, I was called to see Mrs. ——, who had just been thrown from an open carriage. An examina-

tion showed severe contusions about the left shoulder and over the left scapular region. There was also a slight injury of the scalp, and the left radius was fractured. There was no sign of injury about the front of the chest. Considering the severity of the injuries, the general condition of the patient was good. She complained of considerable pain in the left arm, shoulder and back, but there was no pain about the chest. Careful examination did not show fracture of any of the ribs, although the pain under the left scapula pointed to the possibility of fracture of an underlying rib. *Examination of the heart and lungs was entirely negative.* Thirty hours after the accident the patient sent for me hurriedly, to say that a few minutes before she had felt a peculiar grating sensation under the sternum, which had lasted several minutes and then disappeared. A second examination of the heart and lungs was also negative. When I saw her the following morning she complained that the grating sensation had returned, and that she could now both hear and feel it. Examination over the chest showed the presence of a most intense to-and-fro pericardial friction rub on both palpation and auscultation. Nothing abnormal could be heard about the lungs, but later in the day a pleural friction rub was heard over the lower left back, which soon spread towards the axilla and over the lower left front. The loud pericardial friction rub continued to be heard over the entire præcordial region for one week, when it rapidly cleared up, and by the ninth day had entirely disappeared. About the same time the pleural signs also disappeared. At no time was there evidence of fluid in the pericardium or in the pleura. Over the præcordial region there were occasional sharp attacks of pain, usually lasting but a few minutes. With the exception of the pericardial friction rub and these occasional attacks of pain there were no other symptoms of pericarditis. The pulse was normal, and except for a rise of temperature to 101° on the second and third day, probably due to the external injuries, there was no fever. When last examined, six weeks after the accident, both heart and lungs seemed perfectly normal with no sign of pericardial or pleural adhesions.

In the following case the relation between the injury and pericarditis, found at autopsy, seems equally well established. The infarct in the myocardium appears to owe its origin to the same cause.

Case II.—The patient, E. A. R., aged 55, worker in a brewery, was admitted to the Johns Hopkins Hospital in Dr. Osler's service October 3, 1902. Two days before admission he had been struck a severe blow in the left axilla with a piece of scantling, as it was being pushed through a partition by a fellow-workman. On admission he was suffering from severe pain in the lower left side especially on inspiration, shortness of breath, orthopnœa and cyanosis. Examination showed a large hyperresonant emphysematous chest. Pain on pressure in the lower left axilla indicated possible fracture of the ribs, which was later confirmed at autopsy. Everywhere over the chest sonorous and sibilant râles were heard, and in the lower left axilla the note was somewhat impaired. The heart was much enlarged, with no visible apex beat, the sounds being heard best in the 6th interspace 12 cm. from the mid-sternal line. There were gallop-rhythm and a loud systolic murmur at the apex. Pulse 112 to the minute. The urine contained albumin and casts.

The condition of the heart is especially interesting, as we have the notes of his physical examination just eighteen months before, when he was in the Hospital suffering from emphysema and chronic bronchitis. Then in addition to the typical signs of emphysema, he had an enlarged heart with the apex in the 6th interspace well out towards the axilla, and a loud systolic murmur. Nothing suggesting adherent pericardium was then noted. The principal etiological factors in his history had been alcohol and hard work.

Soon after admission his condition rapidly grew worse, the signs of heart weakness becoming more marked. On the fourth day a pleural friction rub in the lower left axilla and a pleuro-pericardial rub were heard. At the end of two weeks the pleural rub had disappeared, although the pleuro-pericardial rub was heard at intervals up to the time of his death, which occurred just four weeks after the injury. Although carefully looked for, neither a pericardial rub, fluid in the pericardium nor signs of adherent pericardium could be made out during life. Immediately following the injury there had been no fever except a brief rise to 100° on the third day. For several days preceding his death fever was present.

The autopsy notes by Dr. Marshall are of interest. The *anatomical diagnosis* was as follows: Fracture of the 6th, 7th and 8th ribs (left axilla), serous pleurisy; collapse of lower lobe of left lung; acute bronchitis; *subacute fibrinous pericarditis;* dilatation and hypertrophy of both auricles and ventricles; *infarct of myocardium;* chronic mitral endocarditis and insufficiency.

Thorax.—About 1500 cc. bright red turbid fluid in the left pleural cavity. Left lung: Adhesions between left lung and pericardium and a few old adhesions to diaphragmatic surface. Right lung: Adhesions between the lung and pericardium.

The heart with pericardium attached measures 14 cm. in widest part. The pericardium everywhere is closely attached to epicardium by *rather recent fibrous adhesions.* Mitral valve thickened considerably, irregular; no fresh vegetations; papillary muscles shortened; chordæ tendineæ thickened; aortic valve clear, with beginning calcification at root. Both left ventricle and left auricle dilated; myocardium rather opaque brown color; in one place entirely replaced by fibrous tissue. Coronary arteries normal.

The histological changes in the pericardium will be considered later. The infarct of the myocardium, which is about 1 cm. in diameter and situated in the wall of the left ventricle, will be discussed further when we consider traumatic myocarditis.

A brief analysis of these two cases emphasizes certain important facts.

In Case I the relation between the injury and inflammation

of the pericardium does not admit of any doubt. Examinations of the heart and lungs for the first twenty-four hours after the accident were negative. Then plastic pericarditis developed, followed by dry plastic pleurisy. While possibly the pleurisy was secondary to the pericarditis, it seems more probable that both developed independently as the result of the trauma, since the extension of such a non-infectious process as this, from the pericardium to the pleura, or the reverse, seems unlikely. The contusion in this case was over the left scapular region. The inflammation of the pericardium may have started in the posterior mediastinum. It seems possible, however, that the pericardium may have been injured by a *contre-coup* of the heart against the anterior chest wall. There is no reason to believe from the history of the case that inflammation was other than of a simple non-infectious type, such as is frequently seen in the synovia of joints as the result of mechanical injury.

In the second case the conditions are less simple. Here we are dealing with a diseased heart, that a year and a half previous was found to be much hypertrophied, with signs of relative mitral insufficiency. Following a severe blow, with fracture of three ribs in the lower left axilla, symptoms of defective heart action and myocarditis set in. Within four days after the injury a traumatic pleurisy, at first dry, but later with effusion, developed. A marked grade of emphysema of the lungs prevented the true condition of affairs in the pericardium from being made out clinically during life. The immediate cause of death seems to have been a terminal pneumonia four weeks after injury. The anatomical findings show a *recent* fibrinous pericarditis. The visceral and parietal layers of the pericardium are loosely bound together by recent fibrinous adhesions which are just becoming organized. From a microscopical examination of this partially organized exudate, the presence of numerous large fibroblasts, a rich supply of large capillaries, and areas of as yet unorganized fibrin, together with absence of any compact, well-organized fibrous connective tissue, and adult connective tissue cells, point to a process of not more than three or four weeks' duration. In the absence of cultures it is impossible to say with certainty whether the pericardial inflammation was of a simple or of an infectious type. From the stage to which it had advanced, it seems likely that bacterial infection had occurred, whatever may have been the character of the inflammation at the onset. Whether inflammation of the pericardium was secondary to the traumatic pleurisy, cannot be said with certainty, especially since it is not known whether the pleurisy was simple or infectious in character; nor is it known just when the inflammation of the pericardium began. Inflammation of the pleura and pericardium were both probably produced independently by the trauma. A blow in the left axilla would be transmitted with considerable force through a firm emphysematous lung against a much hypertrophied heart. The susceptibility of such a heart, already weakened by disease, to an acute inflammation would seem to be great. Although it cannot be said with absolute certainty that pericarditis in this case was not due to other contributing causes, the development of both pleurisy and pericarditis immediately after the trauma would seem to establish a causal relation with the injury beyond doubt.

With the exception of an occasional general statement in the text-books, that pericarditis may arise from injury, leaving us in the dark as to whether a perforating wound, laceration or contusion is meant, there are not many cases of traumatic pericarditis reported in detail. Billroth[1] has seen cases following left-sided fracture of the ribs, although no actual tear but only a contusion of the pericardium had occurred. He also saw one case following a blow upon the præcordia without fracture. Excluding cases caused by perforating wounds, I have been able to find only four cases in the literature reported in sufficient detail to draw any conclusions from them.

Golebiewski's Case.[2]—A workman aged thirty fell from a height of sixteen feet, fracturing the 6th rib in the left mammary line. Pericarditis with friction rub and some increase in cardiac dulness was first noticed about a month after the injury. There was dyspnœa and a very small, rapid and irregular pulse. At the end of three months the symptoms had entirely disappeared. There is no mention of an associated pleurisy.

Luckinger's Case.[3]—A man twenty-five years of age suffered a severe contusion over the left breast. There was no fracture of the ribs or sternum. Three days later palpitation of the heart, shortness of breath, cyanosis and fever developed. A pericardial rub with some effusion and a systolic and diastolic murmur were present. Later a slight circumscribed pleuritic effusion just below the apex of the heart appeared. The case is again referred to in the consideration of traumatic endocarditis.

Jessen's Case.[4]—A man, known to have been previously sound, fell, striking the left side of his chest against a piece of wood. There was no fracture of the ribs, but two days later evidence of slight tenderness over the 6th rib near the sternum. On the third day the cardiac dulness had extended out slightly both to the right and left; and over part of the body of the heart a fine friction rub developed. There was also a systolic murmur heard at times at the apex. On the sixth day he developed a rapid pulse, general weakness, shortness of breath and palpitation. The subsequent history is uncertain.

Thiem's Case.[5]—A man forty-eight years old received a severe blow on the left breast. There was fracture of the 6th rib between the mammary and the anterior axillary line. Four days after injury there was evidence of pericardial inflammation. Death occurred 16 days after injury. At autopsy no external injury was visible. There were subcutaneous emphysema and hæmorrhage into the intercostal muscles about the fracture. 500 cc. of turbid gray purulent fluid were found in the pericardium, with a thick layer of fibrin over the entire inner surface. The

[1] Billroth, Handbuch der allgem. und speciellen Chirurgie, Bd. iii.

[2] Golebiewski, Atlas and Epitome of Diseases Caused by Accidents. Phila., 1900, p. 208.

[3] Luckinger, Ueber traumatische Endocarditis. Münchener medizin. Wochenschr., 1892, Nr. 18.

[4] Jessen, Ein Fall von traumatischer Pericarditis. Monatschr. f. Unfallheilkunde, Leipz., 1898, 241.

[5] Thiem, Ein Fall von Quetschung- Herzbeutel- und Brustfellentzündung, idem, 1896, 65.

heart was somewhat enlarged with the heart muscle of a reddish brown color.*

Considering the frequency of chest injuries, comparatively few cases of traumatic pericarditis are observed. This is without doubt largely due to the frequency with which pericardial affections of all kinds are overlooked. Many of these cases come under the charge of the surgeons with the symptoms obscured by injuries of a more striking character or run a brief and mild course and thus readily escape notice. Out of a series of 100 cases of pericarditis in the Massachusetts General Hospital analyzed by Sears not a single traumatic case is recorded. Only one case (reported to-night) has been found among the records of the Johns Hopkins Hospital. That cases of this kind are as rare as would appear from this seems highly improbable.

The character of the injury is of interest. Perforating wounds, which for obvious reasons need not be considered here, may of course lead to direct infection of the pericardium. We are concerned now rather with the more indirect effect upon the heart of contusions about the thorax. Blows upon various parts of the chest can produce bruises and contusions of the surface of the heart with or without external evidence of injury. Suspended as the heart is in a sac within which it is quite freely movable, there is possibility of injury either by a direct blow where the heart is in close contact with the chest wall, or apparently as the result of *contre-coup* against the anterior chest wall from blows about the back. In one of my own cases the injury seems to have been by *contre-coup*. As far as I know this had not been pointed out as a possible cause of cardiac injury. As in Case I, there may be little or no evidence of external injury about the chest. Not only in pericarditis, but in traumatic endocarditis, considerable injury of the heart can take place without much evidence externally. There may or may not be an associated fracture of a rib. Of these six cases three show such an associated fracture of one or more ribs; in each of these cases the sixth rib, although in two instances it was fractured not over the pericardium, but well out towards the axilla. In the fatal case, where the injury was confined to the left axilla, the heart was much hypertrophied. That a heart can be injured even by severe concussion in a distant part of the body is shown in the case of reported rupture of a heart valve by a severe fall upon the buttocks. A study of the effects of trauma upon the heart, as shown by Riebold[6] and others in autopsies upon individuals who have died soon after severe thoracic injuries, throws much light upon the causation of traumatic pericarditis, myocarditis and endocarditis. In many cases we find actual bruising of the heart wall. In some cases it shows itself as a slight ecchymosis just under the visceral or parietal pericardium. There may be an actual tearing of the pericardium either with or without laceration of the adjacent muscle or effusion of blood into the pericardial sac. Such an injury may be the starting point of pericardial inflammation. The effect of contusions upon the endocardium and the myocardium will be referred to later.

The *type of inflammation,* like traumatic inflammation elsewhere, is simple, unless secondary bacterial infection occurs. Such invasion may occur through the blood current from an infected focus elsewhere in the body, by direct invasion from neighboring organs, or by extension from the adjacent pleuræ which have become infected. In Case II such a secondary infection with purulent effusion seems to have occurred. In three cases the inflammation was apparently simple. In the remaining cases we have not the data to decide whether or not secondary infection occurred.

The *character of the exudate* varies. It may be plastic in character, giving rise to a friction rub, as is seen in four of the cases, later going on to effusion as it did in three of these. Of the two cases which came to autopsy one showed general recent pericardial adhesions and the other a large (purulent?) effusion.

The *association of pericarditis with pleurisy* is interesting. Traumatic pleurisy is by no means uncommon and it also is usually simple in character unless the lung or chest wall is injured. When both pleurisy and pericarditis are of the simple type, the pleura and pericardium have probably both been injured independently, and there has been no extension of the inflammatory process from one sac to the other. That both the pericardium and left pleura should be so often affected together is not surprising, when we consider how difficult it would be to injure the pericardium without also involving the overlying pleura. The fact that pericarditis secondary to affections of the lungs and pleura is not uncommon in diseased conditions, is no argument for such an extension in simple non-infectious traumatic cases. Where there is an infection of either pleura as the result of a perforating wound of the chest or as the result of a laceration of the lung from trauma, a secondary infection of the pericardium can take place by direct extension. As concerns the relative frequency of traumatic inflammation of the pleura and pericardium I am inclined to think that, considering the total area of pleura and the area of pericardium exposed to contusions of the chest, pericarditis is probably of equal or greater proportionate frequency than pleurisy, owing to the less elastic character of the heart as compared to the lung, and therefore its greater liability to injuries by *contre-coup*.

The *symptoms* of these traumatic cases, as already seen, vary widely. In one of our cases, in which there was only a dry plastic exudate, with the exception of occasional pains about the heart, there were no symptoms. In the cases in which there was much effusion, the symptoms were those ordinarily seen in such conditions—disturbed pulse, palpitation, cyanosis and dyspnœa.

Fever seems to have been present in some of the cases. It

*In a case of traumatic endocarditis reported by Litten (Case V of summary) dry pericarditis developed on the eighth day after injury, and persisted "for a few days." The pericardial features of this case are very briefly discussed.

[6] Riebold, Bemerkungen über die Quetschung der Eingeweide von Brust- und Bauchhöhle. Friedreich's Blätter f. gerichtl. Medizin, 1890.

is often impossible to say whether it was due to the pericardial condition, or to other causes. Of our two cases, it was practically absent in one, and in the other, where it was present for two days, seems to have been due to other causes than pericarditis. The absence of fever points strongly to inflammation of a non-infectious type, in which there has been no secondary bacterial invasion.

Although the few cases here referred to would indicate that traumatic pericarditis usually runs a severe course, I feel sure this is misleading. It is more probable that the mild cases are generally overlooked, and the severe or fatal ones only are recognized and reported. A careful routine examination for cardiac involvement after thoracic injuries will doubtless reveal many mild cases like the first case here reported. Considering the frequency of injuries about the chest, a localized pericardial inflammation without other symptoms than perhaps a slight friction rub is probably of quite frequent occurrence. The "milk spots" upon the pericardium so often found at autopsy without a history of cardiac disease, are in some cases possibly of traumatic origin.

While pericarditis from injury may develop in a perfectly normal heart, an organ weakened by pre-existing myocardial disease would seem especially to favor its development. One of our cases well illustrates this liability.

It is unnecessary here to discuss traumatic pericarditis further. In the symptoms and physical signs, the more severe cases differ but little from the non-traumatic forms. In the more severe cases, especially where adhesions occur, the prognosis and course probably do not differ from the non-traumatic type. Some of the unexplainable cases of occasional sharp præcordial pain following accidents, may possibly be explained by the presence of a few localized pericardial adhesions of traumatic origin. That a slight exudate in the pericardium, or a localized plastic pericarditis of traumatic origin is probably overlooked, much more frequently than it is recognized, will scarcely be denied by those who are familiar with the discrepancy between the clinical recognition and the autopsy findings in non-traumatic pericarditis. A systematic examination of the heart in contusions about all portions of the thorax will alone give us an idea of its frequency.

Traumatic Endocarditis.

That acute or chronic endocarditis may develop in a heart previously sound as the result of injuries of the endocardium produced by contusions about the thorax, is even less generally known than is the occurrence of traumatic pericarditis. I am able to give you the clinical history of a case of traumatic endocarditis occurring in the practice of Dr. Cary B. Gamble, Jr., to whom I am indebted for the following notes:

Case of A. B.; white; aet. 24. Seen in March, 1899. The family history was negative. The patient had always been unusually healthy, with no history of past illness except that three years previously he had a chancre, for which he had taken a thorough course of treatment extending over three years. He was an amateur athlete and football player. When first seen he was suffering from obstruction of one side of the nose as the result of an old fracture of the septum, which caused a chronic post-nasal catarrh. The following note on the physical condition was made: Medium sized, powerfully built, athletic looking man. Lungs clear, expansion above the average. *Heart: apex in normal position, sounds clear, soft and strong.* The septum was straightened with relief of the nasal symptoms.

The following December, eight months later, the patient consulted Dr. Gamble as to the condition of his heart. Ten weeks before, while playing half-back on his football team, he was running through the opposing line with the ball, his body bent forward, when a player on the other side was seen to kick him violently in the chest. He fell, was picked up unconscious, and remained so for some time before he regained consciousness. A large bruised spot was seen over the cardiac area, but there is no mention of a fracture of the rib or sternum. He was ill in bed for four weeks with great weakness following. During this illness his symptoms were all cardiac; pain, shortness of breath, palpitation, and for the first few days fever of a moderate grade. The accident occurred early in October. December 20 the following note was made by Dr. Gamble: "General condition good. Pulse 90, regular, strong. Heart: apex in 5th interspace, ½ *inch outside nipple line*, visible, no thrill. At the apex there is heard a *loud, systolic murmur* which is transmitted back to the angle of the scapula and is heard all over the cardiac area with maximum intensity at the visible apex." A year after the above note was made, the condition of the heart was practically the same, except that the pulse rate had fallen to 70 and there was no consciousness of the heart's action. Dr. Gamble is of the opinion that the patient had a traumatic endocarditis involving the mitral valve, with resulting regurgitation.

The important points in this case are: (1) Eight months previous to the accident, the heart was entirely normal; (2) the contusion of the chest was not associated with fracture of the ribs or sternum; (3) the immediate onset of the acute cardiac symptoms with fever; (4) the development of chronic mitral insufficiency. On the other hand, the history of lues suggests the possibility of some pre-existing cardiac lesion, although the thoroughness of the treatment, the involvement of the mitral valve and the negative character of the previous heart examination are strongly against this.

In an examination of the comparatively few cases of traumatic endocarditis which have been reported they are found to fall into three groups:

1. Those in which symptoms of acute endocarditis develop, either at the time of the accident or within a short period afterwards, and which may or may not run into chronic endocarditis.

2. Cases in which at a varying interval after the trauma a chronic endocarditis gradually develops.

3. Cases in which following injuries in various parts of the body, without actual injury of the heart itself, micro-organisms gain entrance to the circulation and set up second-

ary inflammation of the endocardium. This group is only indirectly of traumatic origin and need not be considered, as the heart involvement is merely an accident in a more general infectious process.

Acute Traumatic Endocarditis.—The case just reported is an example of the first or acute type. In addition to this we have been able to find five other cases which fall into the same group. In these cases there is no question as to trauma being the immediate cause of the cardiac lesion. The heart, except in one case, is known to have been normal previous to the injury.

A brief synopsis of three cases in connection with the one just reported will give a fair idea of the similarity of the features which they present. The principal features of the remaining cases are given in the "Summary."

Litten's[7] *Case (II).*—A young German army officer had his chest crushed against a post by a horse. He had previously been examined several times by army surgeons and was known to be perfectly sound. Immediately after the accident he was seized with severe pain in the left chest. Within the next day or two typical symptoms of acute endocarditis *with fever* set in. In the second week a loud systolic murmur developed at the apex. In the fourth week the constitutional symptoms began to show gradual improvement. When seen by Litten, six months after injury, shortness of breath on exertion was still present, and examination of the heart showed enlargement of both ventricles, a systolic thrill and loud systolic murmur at the apex, an accentuated second pulmonic sound, and at the aortic area a very loud rough systolic murmur. Diagnosis: Mitral insufficiency and beginning aortic stenosis.

Litten also reports two other cases of acute traumatic endocarditis. These will not be considered here in detail, but the principal features which they present are shown in the "Summary," cases IV and V.

In *Luckinger's*[8] *case (III)* in a man 25 years old, following a contusion of the left chest without fracture of the ribs or sternum, palpitation of the heart, shortness of breath, cyanosis and fever developed on the third day. At the apex a double murmur was heard. There was also slight effusion into the pericardium. Complete recovery seems to have occurred within a few weeks.

The following case illustrates the anatomical condition in an acute inflammation of the endocardium a short time after injury.

In *Riedinger's*[8] *case*, there was an autopsy upon a woman 54 years old, three days after injury caused by a fall from a considerable height, without fracture of the ribs. Hæmorrhages were found under both the pericardium and endocardium with laceration of the mitral valve at the insertion of the papillary muscles. Some thickening of the papillary muscles indicated possible pre-existing disease. There was a *deposit of fibrin at the base of the mitral valve* at the point of laceration.

As previously stated, the special interest in these cases lies in the fact that the relation between trauma and the subsequent endocarditis is not questionable. The result of acute traumatic endocarditis as shown by these few cases may be recovery, chronic valvular disease, or death.

[7] Litten, Die Endocarditis und Ihre Beziehungen zu anderer Krankheiten. Verhand. Congress f. inner. Med., xviii, 1898.

[8] Riedinger, Ueber Herzaffectionen nach Unfällen. Monatschr. f. Unfallheilkunde, 1894, 351.

Chronic Traumatic Endocarditis.—Of the second group of cases, in which at a varying interval after the trauma, chronic endocarditis gradually develops, there are more numerous instances reported. Here endocarditis in nearly every case showed itself as chronic valvular disease. In this group we must be most careful in determining that trauma is the cause, and not a mere accidental occurrence in the course of endocarditis developing from other causes, especially if we have no note upon the heart previous to the injury. In selecting such cases I have carefully excluded all instances (a) in which there is reasonable doubt as to the previous condition of the heart, (b) where the interval between the injury and recognition of cardiac disease seemed too long, (c) where other etiological factors than trauma appear to have entered, or (d) where the cases are not reported in sufficient detail to determine the character of the heart lesion. In selecting only the cases which fulfill all these requirements, we probably exclude many cases which should be classed under traumatic endocarditis, especially those which develop after trauma in previously diseased hearts. In all some nine cases of chronic traumatic endocarditis have been found answering these requirements. Of these Litten[9] has reported 1; Allbutt,[10] 2; Riegel,[11] 1; Stern,[12] 1; Heidenhain,[13] 1; Riedinger,[14] 1; Oppenheim,[15] 1; Ritter,[16] 1. I have not thought it advisable to refer in detail to these cases individually, but to present a brief analysis of them together with the five acute cases which later developed into chronic valvular disease; in all 14 cases. Such an analysis brings out some rather interesting points. The appended "Summary" shows the principal features of each case in a tabular form.

Location of the contusion.—Of these 14 cases in 12 instances the contusion seems to have been over the præcordia or about the anterior part of the chest; in 2 cases (Stern and Oppenheim) there was a fall from a ladder upon the back (*contre-coup*).

The extent of the external injuries.—The severity of the external injury varies. While in one case this was sufficient to fracture the sternum, in no case was there a fracture of the ribs reported. In several of the cases there seems to have been no external evidences whatever of injury.

[9] Litten, Ueber traumatische Endocarditis. Aerztliche sachverständige Zeitung, 1900, No. 24.

[10] Allbutt, On Overwork and Strain of the Heart and Aorta. Trans. Clin. Soc., Lond., vi, p. 112.

[11] Riegel, Zur Lehre von der chronischen Myocarditis. Zeitschrift f. klin. Medizin, xiv, p. 328.

[12] Stern, Ueber traumatische Entstehung innerer Krankheiten. Jena, 1900, p. 21.

[13] Heidenhain, Ueber die Entstehung von organischen Herzfehlern durch Quetschung des Herzens. Deutsche Zeitschrift für Chirurgie, Bd, xli, 1895.

[14] Riedinger, Ueber Herzaffectionen nach Unfällen. Monatsch. f. Unfallheilk., 1894, 351.

[15] Oppenheim, Die traumatischen Neurosen. Berlin, 1892, Beob., xxv, p. 69.

[16] Ritter, Mitralstenose in Folge Fractura Sterni. Berl. klin. Wochenschr., 1889, p. 699.

Subsequent valvular disease.—In every instance the result was chronic valvular disease, except in one case (III), where the murmurs ultimately disappeared.

Character of the valvular lesion.—Of the type of the valvular lesion we find in 6 cases mitral stenosis alone; in 3 cases mitral insufficiency alone; in 1 case aortic stenosis; in 1 case mitral insufficiency and aortic stenosis (aortic endocarditis); in 1 case mitral insufficiency with stenosis and aortic insufficiency with stenosis; in 1 case mitral endocarditis; in 1 case aortic insufficiency. *The interval after the injury* when valvular disease was established cannot be accurately determined. The only data we can usually give is the time of the first recognition of the murmur. In 2 cases this was heard soon after the injury, on the 10th and 14th days, respectively; in 1 case 18 days; in 2 cases 6 weeks; in 1 case 4 months; in 1 case 5 months; in 2 cases 8 months; in 1 case 12 months; in 2 cases 18 months.

Symptoms.—In about half the cases, following the injury there was *pain about the heart.* In 7 cases the blow on the chest is stated to have produced *unconsciousness.* In 6 cases distressing cardiac symptoms came on immediately after the injury, while in 4 cases acute symptoms with fever developed within a few days. In the remaining cases there were only indefinite symptoms of heart injury until several weeks or months afterwards. In 5 cases *fever* is mentioned as occurring in connection with other acute symptoms of endocarditis. In only 1 case is the chronic valvular disease reported as terminating fatally. It seems unnecessary to continue this analysis further, as in other respects valvular disease resulting from traumatic endocarditis appears to resemble chronic valvular disease of non-traumatic origin.

To sum up the facts just presented, we can say that following an injury about the thorax, endocarditis may develop rapidly, or come on gradually after the elapse of a considerable interval. Chronic valvular disease is the usual outcome.

Unconsciousness following the injury in some cases may be the result of extreme shock to the nervous mechanism of the heart directly or reflexly. The cardiac involvement may be out of all proportion to the extent of the external injuries. The injury while usually direct, appears at times to be by *contre-coup.* The mitral valve is affected in a very large proportion of cases. The frequency of mitral stenosis is to be noted. Injuries of the right heart are comparatively rare. The onset of acute cardiac symptoms with fever, a short time after the injury, which occurs in some of the cases, points to a secondary infection of the injured endocardium, as also does the progressive character of the lesion in the more chronic cases. In general the subsequent history of the cases is similar to other forms of valvular disease.

Many of the facts which have just been pointed out are explained when we study the effects of external trauma upon the endocardium and myocardium as seen at autopsy after death from severe thoracic injuries (Riebold[16]). The interior of the heart may merely show scattered patches of ecchymosis beneath the endocardium. There may or may not be actual laceration of the endocardium. Hemorrhage often extends into the myocardium which is bruised or lacerated. Actual rupture of the heart has been found. There is often laceration of the papillary muscles and chordæ tendineæ, especially of the mitral valve. This explains the frequency of subsequent mitral disease. Actual complete rupture of a valve curtain seems rare, but does occur. All this may occur in a perfectly healthy heart, although the susceptibility of a previously diseased heart would seem to be especially great. The period in the cardiac cycle at which the contusion occurs, may possibly influence the character of the lesion. A blow upon the ventricle when filled would seem to throw an unusual strain upon the papillary muscles and chordæ tendineæ of the mitral and tricuspid valves, while an empty ventricle would favor a contusion of the endocardium or myocardium.

It does not seem well to pass over this subject without referring to "*rupture of the heart valves,*" which is known to occur occasionally, although in this connection we are concerned more with the remote effects of trauma, than with the direct mechanical effect of actual rupture of the valves. In actual rupture symptoms of insufficiency with cardiac murmurs develop immediately after the laceration of a valve segment. Stern has analyzed 35 cases collected by Barié.[17] Of this number 23 were classed by Barié as "spontaneous;" i. e. they occurred in a diseased heart, either without apparent cause, or as the result of an increase in the arterial tension produced by a sudden muscular exertion. The remaining 12 cases were considered by Barié as "traumatic" in origin. Of these 12 there were 9 instances of rupture of the aortic valve and 3 instances of rupture of the mitral. Stern has made a careful analysis of the cases and comes to the conclusion that in all of the 9 aortic cases it is impossible to exclude a sudden increase in the arterial tension produced by exertion acting upon a diseased valve, as the immediate cause. However, I am unable to see why trauma might not produce rupture of an aortic segment by increase in the aortic blood pressure through a contusion of the large vessels of the thorax. Of the 3 "traumatic" cases of ruptured mitral valve, 2 which came to autopsy did not show rupture of the valve itself, but merely of a few papillary muscles. Stern concludes that actual rupture of an aortic valve from trauma alone is very rare, and that in the so-called "traumatic ruptures" of the mitral valve we are usually dealing with an endocarditis developing from an injury of the endothelium or papillary muscles, rather than with actual rupture of a valve segment itself.

Nature of the inflammation.—Autopsy reports unfortunately throw but little light upon the character of the reaction in the endocardium following trauma. It would seem possible that in some cases the inflammation is of a simple, non-infectious character; i. e., there may be merely the formation of granulation tissue at the injured point, without a secondary invasion of micro-organisms. If such scar tissue is in a posi-

[17] Barié, Recherches clinique et expérimentales sur les ruptures valvulaires du coeur. Rev. de Médicine, 1881.

tion to project into the blood current, a murmur might even develop, but it is hard to understand how such a simple non-infectious process could be progressive in character, unless it was very extensive, or so placed as to actually interfere with the function of the heart or valves.

In cases of traumatic endocarditis going on to chronic valvular disease it seems certain that there has been a secondary infection of the injured part by micro-organisms which have gained entrance to the circulation. The presence of fever and other symptoms of an acute infectious endocarditis, as well as the progressive character of the lesions in the more chronic cases, as illustrated by the frequent occurrence of mitral stenosis, can scarcely be explained on any other grounds. Just how bacteria gain entrance to the circulation

SUMMARY OF CASES OF ACUTE AND CHRONIC TRAUMATIC ENDOCARDITIS DEVELOPING INTO VALVULAR DISEASE.

Reference	Sex: Age	Character and Location of External Injury	Fracture of ribs or sternum	Symptoms at time of injury	Onset of Cardiac Symptoms	Cardiac Symptoms	Fever	First recognition of valvular disease	Valvular Lesion	Complications	Result
I. Case here reported	Male; 24	Kick on chest	None	Unconsciousness	First or second day	Dyspnœa, palpitation; pain about heart	Present first few days	6 weeks	Mitral insufficiency	....	Condition practically unchanged 1 year later
II. Litten[9]—Case 2	Male;	Chest crushed	None	Pain; not unconscious	Immediate	Dyspnœa; rapid pulse; pain about heart	Present first few days	2 weeks	Mitral insufficiency and aortic stenosis	....	Marked symptoms 6 months later
III. Luckinger[3]	Male; 25	Contusion of left chest	None	Slight	3d day	Symptoms of acute endocarditis	3d day	Uncertain	Mitral insufficiency	Pericarditis with effusion; traumatic pleurisy	Disappearance of murmur in few weeks
IV. Litten[9]—Case 3	Male; 32	Severe blow on left chest with handle of windlass	None	Unconsciousness?	Immediate	Pain over heart; shortness of breath; palpitation; rapid pulse; irregularity	. ..	18 days	Mitral endocarditis	....	Uncertain
V. Litten[9]—Case 4	Male; 21	Contusion on chest and back	None	Unconsciousness	Immediate	Pain about heart; shortness of breath; palpitation; irregularity	Present soon after injury	10-12 days	Mitral insufficiency	Onset of dry pericarditis 8 days after injury—lasted a few days—completely cleared up	Chronic mitral insufficiency
VI. Litten[9]—Case 1	Male; 47	Severe fall on left chest	None	Unconsciousness	Very gradually a few days later	Rapid pulse; palpitation	None mentioned	8 months	Aortic insufficiency	....	Present 3 years later
VII. Allbutt[10]—Case 1	Male; 14	Kick on chest	None	Oppression about the heart; pain and palpitation	Immediate	"All the usual symptoms of mitral stenosis"	....	18 months	Mitral stenosis	....	Subsequent history unknown
VIII. Allbutt[10]—Case 2	Male; 16	Blow on chest with cricket ball	....	Unconsciousness	Immediate	Palpitation	...	12 months	Mitral stenosis	....	Unchanged 12 months later
IX. Riegel[11]	Male; 44	Kick on chest	None	Pain, shortness of breath	Gradually developed in 4 weeks	Œdema; cyanosis; irregularit ; shortness of breath	None mentioned	18 months	Mitral stenosis	Myocarditis	Death 4 years later
X. Stern[12]	Male; 35	Fall on back from ladder	None	Principally referable to other injuries	Gradually after several days	Pain about heart	None mentioned	6 weeks	Aortic stenosis	....	More marked in 3 months
XI. Heidenhain[13]	Male; 49	Severe contusion of chest	None	Pain and shortness breath	Gradual development	Cardiac pain; palpitation; shortness of breath	None mentioned	5 months	Aortic insufficiency; aortic stenosis; mitral insufficiency; mitral stenosis	...	Living 5 months later
XII. Riedinger[14]	Male;	Contusion of chest	None	None	3d week	Apparently those of acute endocarditis	3d week	Uncertain	Mitral stenosis	....	Uncertain
XIII. Oppenheim[15]	Female; 23	Fall on back from ladder	None	Unconsciousness	3d week	Palpitation and very rapid pulse	....	8 months	Mitral stenosis	....	Unchanged
XIV. Ritter[16]	Male; 34	Severe blow on chest	Sternum fractured	Unconsciousness	Immediate	Palpitation; severe cardiac pain	None	4 months	Mitral stenosis	....	Symptoms marked 4 months after injury

cannot be certainly determined. Litten [8] thinks that a slight associated traumatic focus in the skin or lungs in these cases, may be the portal of entry. In experiments upon animals in which the endocardium is injured by passing a probe into the interior of the heart through the great vessels, unless secondary infection occurs, healing is rapid and complete. While it is doubtless true that the endocardium is often injured and healing takes place as in wounds elsewhere without producing permanent alterations in the heart, it is important to bear in mind that such injuries, as in the cases here brought to your attention, may be the starting point of subsequent progressive valvular disease.

Traumatic Myocarditis.

In discussing traumatic pericarditis and endocarditis, reference has already been made to the effect of trauma upon the heart muscle, and we have seen that, following external contusion of the thorax, hemorrhages into the muscle, contusion, laceration, or even rupture of the heart wall may occur. Moreover, in traumatic inflammations starting in the pericardium or endocardium some reaction in the adjacent muscle may follow, giving rise to more or less inflammation of the myocardium. The muscle fibers destroyed by trauma are replaced in the repair process almost entirely by connective tissue. Unless the extent of the injury is great, or there is subsequent infection of the contused area, the development of progressive myocardial disease seems unlikely in the case of a previously sound heart. Yet this sometimes does occur. If, however, we are dealing with a heart already the seat of myocardial disease, or one in which the reserve resistance is lowered by pre-existing hypertrophy, the liability to serious myocardial changes following injury is increased. That so few cases of traumatic myocarditis are reported is probably to be explained in the following way: (a) In severe laceration of the heart muscle, death usually results. (b) In injuries of moderate severity in a normal heart, repair without ill effects probably occurs in the majority of cases, while if myocardial changes do take place, they are in association with serious endocardial or pericardial disease and are obscured for a time by them. (c) If, however, we are dealing with a previously diseased heart, even if the relation between trauma and myocarditis seem close, we feel that we should be cautious in necessarily assuming a causal relation.

One of the cases here reported under traumatic pericarditis is also an example of infarction of the myocardium developing in a previously diseased heart as the result of trauma. We are fortunate in this case in having the causal relation between trauma and the subsequent myocardial lesion established by the histological findings, which show a process of about the same duration as the injury.

The clinical features of the case have already been referred to in sufficient detail. It may be recalled (Pericarditis, Case II) that the patient was known to have had an enlarged heart a year and a half before injury, but had not previously shown acute symptoms of a diseased myocardium. Immediately following the injury, gallop-rhythm, rapid pulse and other signs of defective heart action were noted. Autopsy four weeks after injury showed a recent infarct of the myocardium in addition to the fresh adherent pericardium already referred to. This infarct was about 1 cm. in diameter, and was situated in the wall of the left ventricle. Macroscopically it was grayish in color and of the usual wedge shape. On microscopical examination it was found to be made up almost entirely of muscle fibers beginning to undergo necrotic changes. The muscle fibers are cloudy, have lost their well-defined outlines, and the nuclei show fragmentation. Scattered among the disintegrating muscle fibers are numbers of fibroblasts and embryonic connective tissue cells. The whole picture is that of a recent necrosis of the myocardium with commencing connective-tissue formation. The process appears to be of about the same age as that already described in the pericardium, and to date from about the time of the injury.

Just how trauma produced infarction of the myocardium is not certain, but injury of one of the branches of the coronary artery by contusion of the heart wall, would explain the lesion. At all events there seems to be some close association between the injury and the formation of the infarct. The myocardium showed no other changes except a general hypertrophy of the walls of both ventricles.

We have been able to find four cases of myocarditis reported in which the causal relation between trauma and myocardial disease seems established. The condition seems of sufficient rarity to justify a brief synopsis of these cases.

1. *Mendelsohn's* [18] *Case.*—Strong and healthy man, 26 years of age. Previous examinations of heart negative. He was first examined three weeks after his chest had been crushed against a wall by a vicious horse. He was rendered breathless by the injury, but did not become unconscious. There was considerable pain about the chest, with weakness and shortness of breath. On examination, three weeks after the injury, he was found to be short of breath and cyanotic. Pulse small, rapid and irregular. Heart distinctly enlarged, especially to the right. There were no murmurs. His condition gradually grew worse, and œdema developed which yielded to digitalis. Eight months after the injury his condition is reported as serious, with marked symptoms of myocarditis.

2. *Stern's* [19] *Case* (*I*).—Man 19 years old, sustained a severe contusion of the chest without evidence of external injury. Examination of the heart after the injury absolutely normal. Two days after the accident traumatic pneumonia and pleurisy developed. With the clearing up of the pulmonary condition rapid pulse and cyanosis persisted, but there were no murmurs, and the heart dulness was not increased. For several months attempts to work were followed by shortness of breath. An examination eleven months after injury showed increased heart dulness, persistent small and weak pulse but no heart murmur. Three years later typical signs of myocarditis were present. Marked cyanosis, dyspnœa, small irregular pulse and pulsation of vessels of neck. There was great increase in the heart dulness,

[18] Mendelsohn, Ein Fall von traumatischer Myocarditis. Deutsch. med. Wchnschr., 1898 (xxiv), Ver. Beil., 25.

[19] Stern, Über traumatische Entstehung innerer Krankheiten. Jena, 1900, p. 46.

especially to the right and at the apex and tricuspid area, a soft systolic murmur.

3. *Stern's*[20] *Case (II).*—This second case is somewhat similar to the last, but symptoms of myocarditis did not develop as rapidly after the injury, so that a causal relation is not as certain as in the last case. As in the last case, the signs of myocarditis were typical. There were also associated nervous disturbances in the heart's action.

4. *Riegel's*[21] *Case.*—Here there seems to be little doubt of the relation between a severe præcordial contusion and cardiac symptoms which set in immediately afterwards, in the case of a man 44 wears old who was kicked by a horse. The condition gradually became worse, symptoms of myocarditis and mitral stenosis developing, and resulting in death four years later. At autopsy, in addition to mitral stenosis, there was *extensive fibro-myocarditis of the left ventricle,* especially in the anterior wall near the apex.

5 and 6. *Hochhaus's*[22] *Cases.*—Two cases are cited by him. In both of these cases the relation between trauma and myocarditis, while probable, cannot be said to be definitely established. Stern refers to other reported cases of so-called traumatic myocarditis, but the part played by trauma seems open to question.

From an examination of the foregoing cases, and a study of autopsy reports, it can scarcely be doubted that myocarditis occasionally develops as the result of contusions of the chest. From the scarcity of reported cases, myocarditis of traumatic origin cannot be common, although the traumatic origin of some cases is probably overlooked. As in other traumatic affections of the heart, the evidences of external injury probably bear but little relation to the severity of the cardiac injury. Myocarditis may thus develop in a heart previously sound, but the susceptibility of diseased heart muscle must certainly be greater. Disturbances in the nutrition of the heart, by interference with the blood supply, or by actual destruction of the muscle substance, are probably the usual form of injury. In the case here reported there was an infarct of the myocardium. The left ventricle is probably the one most frequently injured. Symptoms may develop immediately, or come on gradually after injury. Traumatic endocarditis may be associated with traumatic inflammation of the pericardium and endocardium. That serious myocarditis can develop as the result of the direct extension of traumatic pericarditis, as asserted by Bamburger[23] and Friedreich,[24] seems quite probable. In other respects myocarditis of traumatic origin does not seem to differ from the non-traumatic forms.

Other Effects of Trauma Upon the Heart.

"Dislocation of the heart."—This is claimed to have occurred as the result of trauma in a case reported many years ago by Stokes.[25] It seems probable, however, that the displacement of the heart to the right was secondary, and the result of adhesions to the right pleura and shrinkage of the right lung, rather than actual mechanical displacement at the time of injury.

Aneurysm of the heart.—The older writers referred to the development of the aneurysm of the heart wall from trauma. Cases are said to have been reported by Dionis and Zannine. The reports are so meagre that definite conclusions cannot be drawn from them. No example of aneurysm of the heart following contusion of the chest has been found in the recent literature. A case is reported by Mühlig[26] in which aneurysm of the right ventricle followed a stab wound of the heart. There seems to be no reason why aneurysm should not develop in a heart weakened by trauma or by subsequent connective tissue formation, but with this exception no case of undoubted traumatic origin has been found.

Cardiac neuroses.—After accidents marked disturbance in the action of the heart may develop. This can occur after concussion in which there may or may not be any actual thoracic injury, or it may follow mere mental shock. Either immediately after the injury or at a varying interval, associated with other symptoms of hysteria or neurasthenia, there may be a great increase in the rapidity of the heart's action, or even some irregularity. This condition must be carefully differentiated from traumatic myocarditis. The condition is probably a purely functional one, as in the case of other traumatic neuroses, and is not due to any special injury of the nervous mechanism of the heart.

It should also be borne in mind that pre-existing disease of the heart, whatever its nature, may be aggravated as the result of accidents of various kinds. This may be brought about in several ways; as the direct effect of actual concussion of some part of the body, as the result of some unusual muscular exertion at the time of the accident, or reflexly through the psychical influence of the accident. All three of these factors must be considered in the exacerbation of cardiac disease following accidents.

From a study of the cases here presented, it seems established that not only may pre-existing disease of the heart be aggravated by trauma, but that in a heart previously sound, pericarditis, endocarditis or myocarditis may develop as the result of cardiac injury produced by contusions about the thorax, often without any external evidence of trauma.

Discussion.

Dr. MacCallum.—I have seen in one of these cases the sections from the pericardium, but I am not convinced that they represent a simple, non-bacterial form of inflammation. There was a great deal of exudate and a good deal of proliferation of granulation going on, and it is difficult to understand how that could take place without the intervention of bacteria or some other irritating material. As to the occurrence of *contre-coup,* that seems difficult to understand also in view of the fact that the structures in the chest are so elastic. The

[20] Idem, p. 50.

[21] Riegel, loc. cit.

[22] Hochhaus, Beiträge zur Pathologie des Herzens. Deutsche Uebersetzung von Becker, Leipzig, 1836, 171.

[23] Bamburger, Lehrbuch der Herzkrankheiten. Vienna, 1857, 160.

[24] Friedreich, Krankheiten des Herzens. Virchow's Handbuch der spec. Pathol. u. Therap., v, 2, Erlangen, 1861, p. 153 et seq.

[25] Stokes, A case of probable dislocation of the heart from external violence. London Med. Gaz., 1831, viii, 560

[26] Mühlig, Constantinople. Gaz. Med. d'Orient, iv, Sep. 6, 1860.

contre-coup with which we are familiar takes place most often in the skull, where the contents are enclosed compactly in a rigid structure, a condition entirely different from that in the chest.

Dr. McCrae.—I was very much interested in this paper and I think a point of special importance is in reference to the probability of the association of bacterial infection. It would seem reasonable to suppose that one could have such a condition with or without organisms, just for instance as a simple inflammation in the knee joint may occur without bacteria. Like Dr. MacCallum, I am inclined to doubt the possibility of its production by *contre-coup,* not only for the reasons he gave, but because Dr. Pleasants said that the right heart nearly always escaped.

Dr. Pleasants.—I think myself that there is usually a bacterial infection, but I do not see why we may not have a murmur, for instance, where the endocardium about the valves has been injured without infection taking place, if the resulting scar tissue so projects into the blood current as to interfere with the flow. Unless subsequent infection occurs such a lesion would probably not be progressive.

In the case of the pericardium I see no reason why at times we may not have a single non-infectious inflammation such as is known to develop in the synovial membrane of joints after trauma.

In regard to the possibility of injury of the heart and its membranes by *contre-coup,* I see no anatomical objections to its occurrence. It seems the most reasonable explanation of single localized pericarditis following blows on the back. Dr. McCrae's objection to *contre-coup* as a possible course of endocardial injury, because of the rarity of traumatic valvular disease of the right side of the heart, is hardly satisfactory when we consider that even after severe blows directly over the præcordia, the left and not the right side of the heart, is the one affected in the great majority of cases of traumatic endocarditis. I think that the true explanation of the relative frequency of chronic valvular diseases of traumatic origin on the left side is to be found not so much in the actual escape from injury of the right heart, but in the greater liability of the injured endocardium on the left side to become the seat of subsequent progressive degenerative changes. The greater susceptibility of the left heart to non-traumatic endocarditis is too well known to require comment.

GIANT CELL SARCOMA OF BONE.[1]

REPORT OF A CASE OF A MEDULLARY GIANT CELL SARCOMA OF THE UPPER END OF THE TIBIA IN WHICH THE TUMOR WAS APPARENTLY COMPLETELY REMOVED BY CHISELLING WITHOUT DESTROYING THE CONTINUITY OF THE TIBIA, AND A DISCUSSION OF THE FACTS WHICH JUSTIFY THIS MORE CONSERVATIVE PROCEDURE.

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Path. No. 4520 (Private Case).—Giant cell medullary sarcoma, occupying the upper end of the tibia. Trauma (contusion) nine years, local pain and tenderness since, symmetrical expansion of the upper end of the tibia two and one-half years. Operation December 4, 1902, curetting and chiselling. Result, April 12, 1903, apparently well.

Clinical History.—White, male, aged 29 years. Nine years ago there was a distinct trauma, a contusion of the upper end of the tibia. At the time of the injury the patient felt only a slight discomfort. He was able to get up and walk about. There was no joint effusion and no locking of the joint. The upper end of the tibia was quite painful and tender for three or four days. Since this injury the patient has always been conscious that the upper end of the tibia was very sensitive to slight contusions. He noticed that when he struck this bone the injury, no matter how slight, caused more pain than if he struck any other bone. Pain without trauma was not at first a symptom, but tenderness has always ben present since a short time after the injury, and on the whole the tenderness to slight contusions has increased. Within the last few years he has noticed that if he walked a long distance his attention would be called to the upper end of the tibia by dull pain. It is a very important symptom that since this slight contusion this part of the bone has been unusually tender, a condition not present in normal bone; also after exertion and traumatism it is painful.

He has observed swelling for at least two and a half years. Without much doubt the swelling has been present longer. The swelling has been very gradual, and even now it is but slight. He does not think that the swelling has been any more rapid recently. The tenderness has been more marked within the last year, and the pain after exertion has also increased within this time. This history almost excludes osteomyelitis. The diagnosis lies between a giant cell medullary sarcoma and a bone cyst.

Examination.—On inspection there is a uniform and symmetrical expansion or enlargement of the upper end of the tibia. It is most marked on the medial and lateral surfaces which are not covered by muscle. The normal concavity of the bone at this place is occupied by a convex

[1] Reported before the Johns Hopkins Medical Society, February 15, 1903, with exhibition of patient.

swelling. On palpation the upper end of the tibia, the so-called head, is found expanded. The surface of the bone feels rougher than the normal smooth shaft beneath. This roughness is composed of fine roundish elevations like a mulberry. It feels very hard, it is not compressible; palpation elicits quite marked tenderness. There is no pulsation.

I have never observed a cyst of a long bone but from the cases in the literature the tenderness in this case seemed more marked than that observed in a benign bone cyst.

X-ray Examination (see Figs. 1 and 2).—Fig. 1 is the antero-posterior view. The shadow in the upper end of the tibia is quite characteristic of a medullary soft giant cell sarcoma when compared with other Roentgen pictures in which the diagnosis has been confirmed by operation. The characteristic features of this shadow are the fine darker



Fig. 3.

lines dividing the light area into lobules of various sizes. The line of demarkation between the light area and the shaft beneath is not very sharp. The dark zone about the light area indicates that the expanded shell of bone is thin. There is no evidence that the tumor has infiltrated into the joint. Fig. 2, a lateral view, is not as good a photograph: it is apparently a little overexposed. This photograph, however, shows the irregular formation of new bone beneath the periosteum on the anterior surface of the tibia.

Operation, December 4th, 1902.—An exploratory incision was first made without the Esmarch bandage. The knife demonstrated that the shell of bone on the medial anterior surface was very thin, and the incision exposed a very hemorrhagic, reddish, soft, friable tumor, a typical giant cell sarcoma. The Esmarch was then applied to the thigh. The upper end of the tibia was first exposed by dissecting flaps of skin. The shaft below the expanded shell was exposed; here the periosteum and the bone were normal. The shell of bone which was expanded above the normal shaft differed not only in its expansion, but in its character. The periosteum could not be separated from it, and the bone was rough. With the chisel a piece of the normal shaft and the shell of bone occupying the anterior medial surface of the head of the tibia were removed. [The shell of bone varied from 2 to 3 mm. in thickness.] This exposed a soft, very friable and hemorrhagic mass, completely filling the medullary cavity. The tumor had uniformly expanded the upper end of the tibia. Almost the entire tumor was shelled out, leaving a large bone cavity about the size of a man's fist. The tumor removed is shown in Fig. 3. It could be easily separated from the medullary tissue of the normal shaft below. The shell of bone left appeared to be from 4 to 7 mm. in thickness. It was not a perfectly smooth surface, but had small cavities (recesses), containing tumor tissue. These cavities were curetted. The bone appeared denser than the normal shaft, but in addition to the cavities mentioned containing tumor tissue, there were pin-point and line depressions; the appearance of bone undergoing absorption. The tumor at no point penetrated the shell of bone, nor did it extend to the articular cartilage of the knee-joint. The entire bone cavity was curetted and swabbed with pure carbolic acid, followed by alcohol, then irrigated with 1:1000 bichloride solution followed by normal salt solution. After this thorough curetting and cleansing the surface of the shell of bone showed to the naked eye nothing suggesting tumor tissue. The wound was then tightly packed with sponges and the Esmarch removed. After waiting a few minutes the sponges were removed from the cavity one by one, and it was found that the shell of bone was perforated by at least twenty-five or thirty quite large vessels, at least as large as the temporal artery. It was necessary to plug each one of these openings with Horsely wax. The oozing from the bone between the vessels mentioned was but slight. This use of the Horsely wax completely checked all bleeding. The bone cavity left at the operation measures at least 7 cm. in length, its greatest width just beneath the knee-joint 4 cm.

Microscopic Study.—The tumor is pretty uniform in its histological picture. It is composed of large giant cells, the nuclei of which are centrally arranged. The stroma of the tumor between the giant cells is a rather loose connective tissue, containing small round and some spindle cells. This connective tissue is very vascular. The histological picture corresponds to the common giant cell epulis.

Post-Operative Notes.—There was no hemorrhage. It was at least two weeks before all the wax was removed. On removing the wax the bone surface was covered with fine red granulation tissue, and with the point of a knife it could be easily demonstrated that new bone was present in this granulation tissue. A microscopic study was made of two pieces of this tissue. Histologically it corresponded to the usual picture of vascular granulation tissue. Here and there one saw a few giant cells which, however, were smaller and contained fewer nuclei than the giant cells of the tumor.

March 1, 1903.—Three months since operation. The

patient has been walking without crutches since the sixth week. There is no restriction of motion at the knee-joint. The cavity is rapidly filling up. The lining granulation tissue is firm and finely granular. At no point is it œdematous or exuberant. It is infiltrated with new bone tissue. The naked eye appearance is that of normal bone granulation tissue. We would expect, if there was a recurrence of the tumor, that the tissue lining the bone cavity would form more rapidly, and assume the appearance of œdematous, friable, tumor tissue, which we have observed in other cases. An anterior and lateral X-ray (Fig. 4 and 5) photograph taken February 28 demonstrates that the shadow of the bone cavity is smaller than the shadow of the original tumor, and the present shell of bone about the cavity is considerably thicker than that about the tumor. There is therefore no evidence yet of a recurrence of the tumor.

Remarks.—I felt justified in attempting to cure this case by curetting rather than amputation because of the following facts brought out in a recent study of bone sarcoma. Among 42 cases of sarcoma of bone observed in Prof. Halsted's clinic in the Johns Hopkins Hospital, we have observed 7 cases of giant cell sarcoma; 3 periosteal; and 4 medullary. These cases may be summarized as follows:

Surg. No. 2706.—Periosteal giant cell sarcoma, surrounding the shaft of the lower third of the ulna. Colored female, aged 45, tumor one year, pain nine months, the tumor pulsates. The patient refused amputation. The operation by Dr. Halsted consisted of resection of both bones of the forearm. The microscope demonstrates a pure giant cell sarcoma. The giant cells infiltrate the muscles slightly beyond the capsule of the tumor. The shaft of the ulna is slightly eroded. The stroma between the giant cells is a very vascular loose connective tissue.

Result.—March, 1903, nine years and six months after the operation, well. The woman uses the arm and supports herself by washing and ironing.

Surg. No. 5696.—Periosteal giant cell sarcoma situated on the anterior surface of the shaft of the tibia at the junction of the upper and middle third. White, male, aged 35. Localized pain in the shaft of the tibia fourteen months. Tumor observed twelve months. The tumor when first observed was the size of a pea and apparently adherent to the periosteum or bone. At the end of eight months it had grown to the size of a hickory nut. It was excised at this time and recurred immediately in the scar. We were not informed of the extent of this operation. The recurrent tumor is about 9 by 3 cm. in diameter. It was adherent to the bone but not to the skin. The operation consisted of excision of the tumor together with an area of healthy tissue and a piece of apparently not infiltrated shaft of the tibia.

Gross Pathology.—This tumor was encapsulated and situated apparently between the periosteum and the shaft of the bone. It was composed of soft, vascular and friable tissue, and contained numerous small cavities filled with blood. The bone was not infiltrated.

Result.—March, 1903, six and a half years after the operation, well.

Surg. No. 12,235—Periosteal giant cell sarcoma situated over the head of the tibia. Female, white, aged 48. The patient noticed a tender area over the left tibia two years ago. A tumor was not observed in this area of tenderness until one year ago. In four months it had grown to the size of a walnut. At this time it was excised by her physician. Recurrence took place at once. A few weeks ago the skin over the tumor ulcerated and a fungous mass protruded. The fungous mass measured about 3 by 3 cm. in diameter and projected 1 cm. above the surrounding skin.

Operation.—Amputation of the thigh through the condyles of the femur.

Gross Pathology.—The fungous tumor is circumscribed. It originates from the periosteum. The outer table of the tibia beneath is but slightly eroded. The center of the tumor is necrotic. Surrounding the necrotic area the tumor tissue is firm, not very friable, but slightly hemorrhagic.

Microscopic Sections.—The tumor is composed of many giant cells. The matrix of the tumor is composed chiefly of spindle cells. Many of the spindle cells are long and some are fibers. The bone is not infiltrated by the tumor cells. The pathological study in this case demonstrates that the tumor could have been completely removed by resection without injuring the continuity of the tibia.

Result.—March, 1903, one year and six months after operation, well.

Remarks.—The first two cases correspond to the so-called pure giant cell sarcoma epulis springing from the periosteum of the alveolar border of the upper or lower jaw. We have observed about ten cases; none have recurred after excision without destroying the continuity of the jaw. The third case corresponds to the fibro-spindle-cell-fibroma epulis of the jaw, except it contains more giant cells. We have observed about six cases; none have recurred after excision.

The giant cell periosteal sarcoma of the long pipe bones is not a very common tumor. It is without much doubt one of the least malignant forms of bone sarcoma, and in the majority of instances should be treated by excision without destroying the continuity of the bone.

Surg. No. 313.—Medullary sarcoma occupying the condyles of the femur. This case is clinically of interest because the symptoms of the new growth simulated a chronic arthritis. The patient was a white male 22 years of age. For seven months he suffered with pain and weakness referred to the left knee-joint, but continued to walk and work. Swelling of the knee had been observed only one month. The patient sought surgical advice because of the great increase of pain and swelling in the knee during the last three days. There was no history of gonorrhœa or lues. The clinical picture was one of effusion into the knee-joint. At the exploratory arthrotomy the synovial membrane was slightly injected and the joint contained clear fluid. It is not noted in the history whether there was any enlargement of the lower end of the femur. The case was observed before the advent of the



FIG. 1.



FIG. 4.



FIG. 2.



FIG. 5.

X-ray. The patient was observed from February 7 to April 16. The arthrotomy gave no relief. Pain continued and the effusion recurred. The aspiration fluid in March contained blood corpuscles.

Second Operation, April 16, 1890.—At the exploratory arthrotomy the effusion was very hemorrhagic. The joint contained a soft, friable, gelatinous, hemorrhagic tissue which perforated the external condyle of the femur and was continuous with similar tumor tissue in the external condyle. The thigh was amputated at the junction of the middle and lower third ten days later. The delay in the amputation was due to the necessity of getting the patient's consent. This patient died eight months after the amputation with symptoms of acute nephritis. There was no positive evidence of internal metastasis.

The microscopic study made at that time states that the tumor was composed of giant and very large spindle cells. For this reason it is a question whether this tumor may be considered a pure giant cell sarcoma.

The remaining three cases of medullary sarcoma, all of which I saw clinically and examined pathologically, are examples of the pure giant cell variety. All of these patients have remained well since operation. In three cases the tumor occupied the lower end of the radius, the fourth the upper end of the tibia.

Surg. No. 3815.—Medullary sarcoma lower end of radius. White male, aged 26 years. The pain and swelling of the lower end of the radius is of three months' duration following traumatism. At the exploratory incision into the pulsating tumor it was found that the lower end of the radius was expanded and occupied by a very vascular, soft, friable tissue, much disintegrated by hemorrhage. A thin shell of bone was preserved everywhere except on the extensor surface. In this area the tumor tissue was covered by thickened periosteum. The arm was amputated below the elbow. The study of the pathological specimen demonstrated that the tumor was completely circumscribed by periosteum and a shell of bone. The probabilities are that it could have been completely removed by resection of about 5 cm. of the lower end of the radius. Microscopically it was composed chiefly of giant cells. The tumor was almost completely disintegrated by hemorrhage.

Result.—March, 1903, 7 years and 4 months, the patient remains well.

Surg. No. 6532.—Medullary sarcoma of the lower end of the radius. This case is of particular interest on account of its relation to Colles' fracture. It is our only observation in which a tumor formed at the site of a fracture. The patient was a white male 45 years of age. Two years and four months ago a Colles' fracture took place after a fall on the palm of the hand. It is to be noted, however, that four months prior to this injury, without any apparent reason, the patient suffered with almost continuous pain in the lower end of the radius. There was no swelling. The recovery from the fracture was apparently normal. In six weeks the man was using his hand in writing. In three months he again began to suffer pain in the lower end of the radius. This local pain continued for three months when swelling was first observed. The swelling was first noticed on the extensor surface of the radius near the joint. Gradually the entire lower end of the radius was expanded. After the swelling had been present about nine months, that is fourteen months ago, an exploratory incision was made into the expanded end of the radius. The surgeon informed the patient that the bone was soft, and that the medullary cavity at the lower end of the radius was occupied by a soft hemorrhagic tissue. The disease was not recognized and the wound was closed without removing any tissue. This is a very important observation, because the exploratory incision into this new growth was made fourteen months before our operation, and as the patient has been observed six years since our operation, we can feel pretty satisfied that internal metastases have not taken place.

Examination.—The lower end of the radius is quite symmetrically expanded. There is no swelling or œdema of the tissues around the bone. The X-ray negative shows a picture corresponding almost exactly to the one reproduced here of the giant cell sarcoma of the upper end of the tibia. The negative demonstrated that the tumor was surrounded by a thin shell of bone intact at every point. The arm was amputated below the elbow.

Pathological Study.—The lower end of the radius is occupied by a very cellular pigmented tumor surrounded by a thin shell of bone; from this shell thin bone partitions extend a few millimeters into the soft tumor tissue. Microscopically the tumor was composed chiefly of giant cells in a matrix of loose vascular connective tissue containing a good many spindle cells. There were many spaces filled with extravasated blood, and there was a great deal of blood pigment, explaining the melanotic appearance of the tumor. The pathological examination demonstrated that the tumor could have been completely removed by resection of the lower end of the radius. It is interesting to note that the few axillary glands removed at the operation because they were enlarged showed blood pigment but no tumor cells.

Result.—March, 1903, five years and nine months after the operation, the patient remains well.

Surg. No. 8409.—Medullary sarcoma lower end of radius. White male aged 28 years. Seven months ago there was a traumatism to the wrist by a baseball. The pain and swelling began directly after this injury and never disappeared. During the last four months the swelling has increased considerably and there has been restriction of motion of the wrist-joint. Palpation and the X-ray negative demonstrated that the tumor has broken through the shell of bone and is infiltrating the surrounding soft parts and tendon-sheaths. For this reason no operation could be considered but amputation, which was done below the elbow. The gross and microscopic pathology of this case correspond to the two cases of medullary sarcoma of the lower end of the radius just described.

Result.—March, 1903, four years and four months after the operation, the patient continues well.

The observations on these seven cases of giant cell sarcoma demonstrate that as yet we have never observed internal

metastases, although in two cases the tumors were recurrent and in one case there was an exploratory incision.

These facts, I think, justify an attempt to remove these tumors by curetting and chiselling, if possible, without destroying the continuity of the bone. If this is not possible the tumor should be dealt with by resection, provided the amount necessary to resect will leave a limb with good function. Amputation is only indicated when the disease has destroyed so much bone, or infiltrated the soft parts to such an extent that resection is either impossible, or if possible, the extent of the necessary operation would leave a practically useless extremity.

These less extensive operations are also justified by cases reported in the literature. These I have discussed in *Progressive Medicine* for December, 1902, p. 150. The cases reported in the literature and those discussed in this communication also demonstrate that if our attempt at removal of the disease is followed by local recurrence the possibilities of internal metastases are apparently not increased, so that as far as observations go, the risk of internal metastases is not increased if in doubtful cases we attempt to cure by curetting or resection. However, it is very important that the surgeon should recognize the pathological variety of the bone tumor. The tumor considered in this paper, the pure giant cell sarcoma, is one in which the less extensive operations are most surely justifiable.

ANGIONEUROTIC ERYTHEMA AND ITS SURGICAL TREATMENT BY NEURECTOMY.

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This condition is apparently one of considerable rarity. The following three cases well illustrate the clinical picture: in one the condition was relieved by division of the nerve over the distribution of which the area of erythema and œdema extended.

Case I.—Angioneurotic œdema of both cheeks, secondary to drainage of the antrum cavities, relieved by neurectomy of the infraorbital nerves. A second area, on the left side of the abdomen relieved by the division of the intercostal nerves. A third area, in the lower abdominal zone, still under observation.

Clinical History.—White, female, aged 17. This patient has been under observation since July, 1900, a period of two years and eight months.

This patient was referred to me by Dr. Randolph, of Baltimore, with the following history: About eight months ago she was under the treatment of a dentist for a cavity in the right bicuspid tooth. Within a week signs of an abscess about the root of this tooth developed. There were pain, swelling and œdema of the gum of the upper jaw, extending into the tissues of the cheek. This swelling persisted for three weeks. At this time an incision was made through the gum over the second molar. The tissues were œdematous, but there was no purulent collection. During the next three months the swelling slightly subsided but did not entirely disappear. The pain and tenderness referred to the right gum and cheek persisted. About this time the second molar tooth was extracted, and a small amount of pus was evacuated. From this opening a slight amount of purulent material continued to discharge. Two weeks later without apparent cause there was considerable swelling and œdema of the cheek between the right eye and the nose. Associated with this there was hemorrhage from the right nares but no discharge of pus. About six weeks ago, without apparent cause, she had a similar attack of swelling and œdema on the left side of the face. For this condition three incisions were made in the gum: one apparently into the antrum, but very little pus, if any, was found. During the last two months she has had peculiar attacks of syncope. These attacks take place sometimes two or three times a day, and there may be a free interval of two to three days or more. The attack seems to consist of apparent loss of consciousness. The patient, however, does not get rigid; she breathes quietly. From the description of the attack one would be inclined to the diagnosis of hysteria rather than of epilepsy. Frequently the attack is preceded by intense pain in the lower left abdominal zone. The patient has lost about twenty pounds in flesh and looks anæmic.

Examination.—The inspection of the face is negative. The second molars on both sides of the upper jaw have been extracted. In the position of the molar there is a small sinus which apparently does not communicate with the antrum cavity. There is at present no swelling or œdema of the gum or cheek. The patient, however, complains of tenderness when the antrum cavities are palpated, and of pretty constant pain referred to both cheeks. Careful inspection of the nasal and pharyngeal cavities demonstrated no pathological condition. There was nothing to indicate any disease of the antrum except the history and the present pain and tenderness. The patient, however, has practically been an invalid during the last eight months on account of this pain and tenderness, and recurrent attacks of swelling and œdema. The abdominal examination was negative, the X-ray shadow showed no stone in the kidney.

Blood Examination.—Red cells, 5,000,000; leucocytes, 12,000; hemoglobin, 85%. Heart and lungs negative. The patient was observed for a week. She was quite hysterical at times, but there were no fainting attacks. She was rest-

less at night and complained constantly of pain and tenderness in both cheeks.

Operation.—July 21, 1900. Ether. The antrum cavities on both sides were opened through an incision above the root of the bicuspid tooth. The size of the opening was about 5 by 8 mm. On opening the left antrum there was very little hemorrhage. The cavity seemed smaller than normal, the mucous membrane was either very œdematous, or it was replaced by granlation tissue. However, as we found no purulent collection in this cavity, I am inclined to think that the pathological condition was one of intense œdema and hyperæmia. On opening the right antrum there was no purulent collection, but the hemorrhage was so profuse from this opening and from the right anterior and posterior nares, that it became necessary to pack the cavity and plug the nares. Every attempt at inspection of the antrum cavity was followed by such profuse hemorrhage that further inspection was abandoned. The patient was allowed to come out of anesthesia, leaving both antrum cavities packed with gauze, and both nares plugged.

The convalescence from the operation was very comfortable. The packing of the antrum cavities and nares was entirely removed on the third day. The patient stated that she was perfectly relieved of the pain and tenderness present before the operation. She left the hospital in two weeks apparently completely relieved. During this time there was no discharge of pus from the antrum sinuses. The patient was advised to keep the small openings into the antra patent.

January, 1901.—The patient returned for observation because of intense pain in the left iliac fossa. These attacks of pain were present only during the period of menstruation. The opening of the left antrum had closed, while the opening into the right antrum was still patent. It is now almost six months since the operation and she has been relieved of the antrum pain and tenderness. After consultation with Dr. W. W. Russell, of the gynecological staff, it was considered best to dilate and curette the uterus. Under ether narcosis the uterus and its appendages were found to be normal. Curetting demonstrated no pathological condition of the lining of the uterine cavity. The operative procedure, however, entirely relieved these attacks of pain up to the present time, February, 1903.

The Development of Angioneurotic Œdema in the Right Cheek.—As the opening into the left antrum had closed and no recurrence of the trouble had developed after some weeks, it was considered justifiable to allow the opening of the right antrum to close. Within a week the patient began to complain of pain in the right side of the cheek; this was associated with almost daily bleeding from the right side of the nose and an area of erythema and œdema appeared in the skin and subcutaneous tissue of the cheek over the right antrum. This area was about the size of a silver dollar, it did not involve the right eyelid nor extend to the nose. There was some fluctuation in the intensity of the redness and the amount of œdema, but the condition never completely disappeared. It had the appearance of an area of skin over an abscess, but the tenderness and pain were not of sufficient degree to suggest a collection of pus in the antrum cavity. There was no fever and no leucocytosis. This area was present on the right cheek only at this time. This area of erythema and œdema which we might call *angioneurotic erythema persistens*, remained in about the same condition from January, 1901, to May, 1902, a period of one year and four months. There were slight changes in color and the amount of œdema, but the area never at any time entirely disappeared. Now and then the pain and tenderness would entirely disappear. In March, 1901, the sinus into the right antrum was reopened. There was no evidence of infection. The mucous membrane was not as œdematous or congested as at the previous operation and there was very little bleeding. This operation relieved the bleeding from the nose and much of the pain and tenderness, and for a short time, the red patch on the right cheek was paler in color.

May 1, 1902.—Although the pain and tenderness in the right cheek were not sufficient to justify an operation, yet when they were added to the marked disfigurement caused by the red and œdematous patch cheek, an attempt at relief seemed justifiable. From the onset of this area of erythema I was inclined to consider the condition similar to angioneurotic œdema, and that without much doubt the original condition in the antrum was not an infection, but a neurosis, i. e. an angioneurotic œdema of the mucous membrane of the antrum cavity. As the infraorbital nerve supplied the area involved, I felt, that its division might relieve the condition, and for this reason on May 1, 1902, the infraorbital nerve on the right side was exposed and divided. Inspection of the tissues through the usual incision beneath the eyelid demonstrated no pathological change. The bony wall of the antrum was exposed, it appeared normal. Almost immediately after the division of the nerve the area of erythema and œdema disappeared. As soon as the patient came out of the narcosis she declared that the pain and tenderness were no longer present. Up to the present time (February, 1903), a period of almost a year, there has been no recurrence of the trouble. Ten days after this neurectomy of the right infraorbital nerve the patient experienced pain in the left cheek and a similar area of erythema and œdema appeared under the left eye. This area corresponded almost exactly to the one just relieved on the right side. The patient was observed for six weeks, and as the condition did not improve, a similar operation was performed on the left infraorbital nerve. The condition of the tissues found on the right side was observed on the left, and fortunately the immediate and permanent relief has been the same.

The Development of Angioneurotic Œdema in the Left Upper Abdominal Zone.—Three days after the neurectomy of the left infraorbital nerve which was performed under chloroform anesthesia a third area appeared suddenly on the left side of the abdomen. It began in the nipple line

at the eighth rib and extended down for a distance of about 6 cm. It corresponded in appearance exactly to the areas described on the cheek. It appeared suddenly one night. The skin over the area was hypersensitive to touch, but slightly anesthetic to pain. The movements of the clothes on this area gave discomfort. Although there was fluctuation in the color, it never disappeared. Observed from June 6 to August 23, the area extended downwards to 1 cm. below the line between the umbilicus and the anterior iliac spine. The width (6 cm.) remained about the same, the length increased from 6 to 19 cm. The patient states that she is always conscious of a sense of discomfort in this area and it is slightly tender to touch. On August 23 under cocaine infiltration an incision was made through the skin and subcutaneous tissue above and to the outer side of the area, dividing everything down to the aponeurosis of the muscle. The erythema immediately disappeared and up to the present time, February 28, a period of six months, there has been no recurrence.

A few weeks after the patient left the hospital, in September, 1902, a similar patch appeared in the left lower abdominal zone, below the one just relieved by neurectomy. This very quickly extended across the middle line and a similar area developed in the right lower abdominal zone. These two areas were similar in their appearance to the others which have been described. Now for the first time the patient began to lose flesh; the blood count, however, showed no marked anæmia: reds, 4,900,000; hemoglobin, 82%. From the first up to the present time careful examination of the heart and other organs showed nothing abnormal. The patient never suffered from tachycardia. The pulse rate, even under narcosis, was always normal. The patient exhibited no other marked hysterical phenomena, except the attacks of syncope which have never reappeared since she came under my observation. On careful questioning I found for the first time that the patient was very unhappy in her home on account of a condition which gave her constant worry and anxiety. For this reason I advised a change of scene. The patient went south and lived in pleasant environment from October, 1902, to January, 1903. During this time she gained in flesh from 107 to 130 pounds. The area of erythema in the right lower abdominal zone disappeared, the area, however, in the left lower abdominal zone has remained about the same, except that it gives less discomfort.

Examination February 27, 1903.—The scars on the cheeks are hardly perceptible. The color of the face is absolutely normal. There is no pain or tenderness referred to either antrum. Sensation in the anesthetic area secondary to the neurectomy of the infraorbital nerves has almost completely returned. The skin corresponding to the first area of erythema on the abdomen is normal in appearance and there are no abnormalities in sensation. The area of erythema in the left abdominal zone as shown in the chart, measures 8.5 by 6 cm.; it is much less sensitive, there is very little œdema; the erythema, however, remains unchanged. The area of erythema in the left abdominal zone has completely disappeared, but the skin over this area is slightly more sensitive to touch than normal. The patient appears in very good health and spirits, and states that the condition does not give her sufficient discomfort to make her wish or be willing to undergo another neurectomy under cocaine anesthesia for its relief.

Remarks.—These areas of erythema differ from the usual cases of angioneurotic œdema first described by Quincke in the persistence of the vasomotor dilatation. Associated with this persistent hyperæmia there is increased sensibility to touch, but decreased sensation to pain; sensation to heat and cold are apparently not disturbed. The areas on the cheek were much more painful and tender than the areas on the abdomen. In all of the areas the erythema could be made to disappear by continuous pressure; the condition, however, reappeared immediately when the pressure was discontinued. The central portion of the area was always of a darker red color, and the redness became lighter towards the periphery. The border of the area was not a sharp line, but there was a zone composed of small patches of erythema and normal skin. The œdema in all of the areas was very slight; in fact, I am inclined to think the swelling could all be explained by the increased amount of blood rather than any actual exudate outside the blood vessels. At the operation I could find no evidence of blood extravasation which is present in forms of purpura hemorrhagica. The condition might be called a localized intense blushing, and most easily explained by vasomotor disturbances; whether peripheral or central it is difficult to ascertain.

This case is remarkable in its multiple areas, in the persistency of the erythema, and is of interest surgically because of the so far permanent relief after neurectomy.

It is to be noted that painting the areas of erythema with collodium decreased the size, but never produced complete disappearance of the area of erythema. For example, on February 27 the area of erythema in the lower abdominal zone measured 8.5 by 6 cm.; on February 28 it measured 6 by 4 cm.

Case II.—*Angioneurotic Œdema of the Mastoid.*—Female, white, married, aged 42. This patient was apparently at the period of menopause. On April 24, 1902, about ten months ago, she consulted me because of pain and tenderness over both mastoids, and a slight area of redness and œdema which comes and goes over the right mastoid. The pain over the right mastoid extends down the neck to the right shoulder and is associated with headache. The pain is fairly constant and at irregular intervals becomes quite intense. It rarely keeps the patient awake at night. There is no history of any previous trouble with either ear.

Examination.—Both mastoids are slightly tender, the right more so. The tissues over the right mastoid are perhaps slightly œdematous and beneath the skin the lym-

phatic gland is felt to be slightly enlarged. The redness which, the patient states, was present yesterday is absent to-day. There is no redness or œdema over the left mastoid. The patient was seen at intervals for ten days. On two occasions, over the right mastoid there was an area of skin of the size of a fifty-cent piece intensely red in color and slightly œdematous. Associated with this the tenderness over the mastoid was slightly increased. The erythema and œdema were out of proportion to the local tenderness. There was no fever or leucocytosis. Dr. Randolph could find no pathological condition in the nares or pharynx. The Eustachian tubes were patent. He removed from the external auditory canal a large plug of cerumen, this plug pressed upon the apparently normal tympanic membrane; it was very hard, and after its removal he observed a slight erosion of the epidermis of the canal. This relieved the condition only for a few days. Clinically the area of erythema and tenderness over the mastoid resembled the one described in the previous case over the antrum, except the redness now and then completely disappeared. The erythema did not extend to the auricle. The urine contained a slight amount of albumen and a few hyaline casts.

Operation.—April 24, 1902. Under cocaine infiltration an incision was made over the mastoid. It is to be noted that on the day of the operation the erythema and œdema disappeared. At the incision all the tissues were found to be normal, except a slightly enlarged and hyperæmic lymphatic gland and the veins which came through the small foramen of the mastoid seemed to me to be slightly larger than usual. I could make out no pathological change in the periosteum or outer table of the mastoid, and for this reason did not chisel the bone. The gland mentioned was removed and the veins ligated.

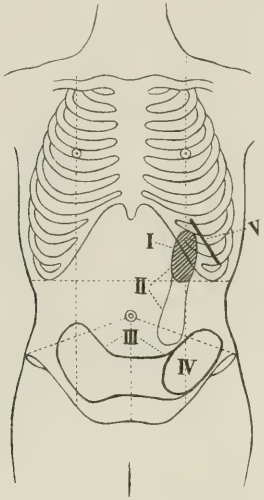
This patient has been observed up to the present time, March 1, 1903. After the operation the patient was free from pain and erythema for about three weeks, since then there have been intermittent attacks. The tenderness is apparently getting less; the erythema appears at longer intervals and is less intense. The pain seldom is referred to the neck and shoulder; the headaches are less. Now and then the pain extends to the ear and over the parotid area. The condition on the left side is present at rare intervals, and is much less severe. Now and then the attacks are associated with slight flushing of the face and ears. The patient informs me that she rests well at night. The attacks of pain and erythema usually come on in the afternoon and evening, especially when she has had a busy day and especially if she has suffered any unusual anxiety. Now that the patient understands that the condition is not a serious one she states that it does not give her sufficient discomfort to make her desire any operative interference. Painting the area with collodium has little or no effect. Covering the area with antiphlogistine has no effect.

The object of my operation in this case was to exclude any inflammatory condition of the mastoid cells; as it is difficult to chisel into the mastoid without a general anesthetic, I did not consider that we were justified in view of her chronic nephritis to give ether for this procedure. The signs could all easily be explained by a local vasomotor dilatation.

Case III.—*Angioneurotic Œdema of the Elbow Joint* (Idiopathic hydrops articulorum intermittens).—I have reported this case in Progressive Medicine, December, 1900, p. 201, with the discussion of the literature on intermittent hydrops. It is my only observation. The patient was referred to me by my colleague, Dr. Smith, of Baltimore. She was a woman 27 years of age; married; no children. Following slight trauma, two years ago, over the anterior surface of the left tibia two ulcers formed, and healed slowly. A year ago she had a slight trauma to the left elbow. Following the trauma it was slightly swollen, since which time she has had remittent attacks of swelling of this elbow-joint. The periods have been pretty regular. The swelling is sometimes associated with slight pain and restriction of motion and the feeling of tingling and numbness in the fingers. On one occasion during a recent attack, without trauma, the other elbow was similarly affected. I saw her at the end of an attack, and there was an area of œdema, confined more to the subcutaneous tissues than to the skin, over the external condyle of the humerus. There was little effusion in the elbow-joint. The skin was normal. Fearing that perhaps there might be a beginning new growth of some kind, although from the history and the careful examination I felt this could almost be excluded, I advised an exploratory operation. A few days before the operation most of the œdema disappeared. At the operation all the tissues were normal except the periosteum. In stripping this from the bone the outer table of the humerus seemed a little rougher than usual. Chiselling into the external condyle, the bone was normal. The wound healed kindly. Following the operation the œdema disappeared in a few days. About three weeks later, without apparent cause, she suddenly had the same swelling of the elbow, associated with a similar one, but to a slighter degree, of the opposite elbow, and a definite area of œdema of the dorsum of the hand between the thumb and index finger. It disappeared after four days. Here we have, therefore, a history of a localized acute œdema, most marked in the left elbow-joint, involving the periarticular tissues, associated with slight effusion, recurring at irregular intervals, and on two occasions associated with a similar condition of the opposite elbow and skin of the dorsum of the hand. The patient was otherwise healthy, but of a marked nervous temperament and very hysterical. In this case the operation and the histological examination of the tissues demonstrated no pathological change. Previous prolonged treatment with mercury and iodide practically exclude lues. I must confess

that until I read Schlesinger's[1] article I was at a loss to explain the condition.

Note April, 1903.—The operation was performed in May, 1900. The subsequent slight attack in June is noted in above history. In July the patient observed that she did not menstruate at the usual time. I saw the patient in October: there were signs of pregnancy in the third month and the patient was absolutely free from all joint symptoms. She was delivered later of a healthy child. In April, 1903, almost three years after operation, this patient again came



Areas of Angioneurotic Œdema observed in Case I.

I. = Area observed May 15, 1902.
II. = Extension of Area I to August 23, 1902.
V. = Incision made August 28, 1902.
III. = Area September 20, 1902.
IV. = Present area, February, 1903.

under observation. An examination demonstrated an area of tuberculosis of the skin of the right forearm of six months' duration, and an abscess over the right sternoclavicular joint of three months' duration. These conditions have been relieved by operation, and the pathological study has proven their tubercular etiology. The left elbow during all this time has never given her any trouble, and she has observed no recurrence of the symptoms mentioned in the former history. Although intermittent joint hydrops is now and then observed as an early symptom of joint tuberculosis, and although the present lesions are undoubtedly tubercular, I do not think that these facts prove that the original lesions were symptomatic of a tubercular focus, but can be more easily explained as due to an angioneurotic disturbance.

Note April 12, 1903.[2]—On Monday evening, March 2, the patient was exhibited before the Medical Society. On that evening there were no areas of erythema, except the one marked "iv" on the abdomen. The following Tuesday night the patient's attention was called to the left arm between the shoulder and elbow by a sensation of pain. The following morning she observed the typical red area which rapidly extended between the shoulder and elbow on the outer side of the arm. There was sufficient pain in this area to keep the patient awake Wednesday night. Thursday morning the patient painted the area with collodium which relieved the discomfort.

Examination Thursday Afternoon.—The area has been observed 36 hours. It occupies the middle of the outer surface of the arm, it is oblong in shape, 11 cm. long and 6 cm. wide, it is covered with collodium. There is unquestionably some œdema which extends a little beyond the area of erythema. This arm, the left, measures 5 mm. greater in circumference. The spot in the left lower abdominal zone (see Fig. iv) has faded since the use of collodium.

On March 10, five days later, the patient was taken with quite intense pain in the abdomen which was soon followed by the appearance of the usual menstrual flow. In a few hours she had the usual prodromal sensation of pain and prickling in an area on the left forearm. The patient being now familiar with the fact that this sensation would soon be followed by a patch of erythema painted the spot immediately with collodium. This relieved the pain very much, and when I examined the area 24 hours later, it was but slightly erythematous.

Note April 1, 1903.—The area on the arm has changed very little, the area on the forearm has extended to the wrist. The condition has not recurred in any of the previous spots.

[1] Mittheilungen aus den Grenzgebieten der Med. und Chir., 1899, i, p. 441, reviewed in Progressive Medicine, December 1900, p., 195.

[2] Reported before the Johns Hopkins Medical Society March 2, 1903, with exhibition of case 1.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

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SUMMARIES OR TITLES OF PAPERS BY MEMBERS OF THE HOSPITAL OR MEDICAL SCHOOL APPEARING ELSEWHERE THAN IN THE BULLETIN.

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NOTES ON NEW BOOKS.

Book on The Physician Himself and Things that Concern his Reputation and Success. By D. W. CATHELL, M. D. The Twentieth Century Edition. Being the eleventh edition revised and enlarged by the author and his son, WILLIAM T. CATHELL, A. M., M. D., Baltimore, Md. (*Philadelphia: F. A. Davis Company, Publishers, 1902.*)

The value of this book to those who wish information upon the practical side of medicine is well attested by the fact that ten previous editions have been issued. The present edition has been carefully revised and is very suggestive and readable. While one might possibly prefer that the number of poetical and proverbial quotations had been fewer or less conspicuously printed, this is simply a matter of taste. This abundance of quotation tends to render the meaning more emphatic and to stimulate the attention of the reader by the introduction of a pithy remark or an illuminating sentence.

The International Text-Book of Surgery. In two volumes. By American and British authors. Edited by J. COLLINS WARREN, M. D., LL. D., F. R. C. S. (HON.), Professor of Surgery, Harvard Medical School; and A. PEARCE GOULD, M. S., F. R. C. S., of London, England. Second edition, thoroughly revised and enlarged. Vol. I. General and operative Surgery. Royal octavo of 965 pages, with 461 illustrations, and 9 full-paged colored lithographic plates. Vol. II. Special or regional surgery. Royal octavo of 1122 pages, with 499 illustrations, and 8 full-paged colored lithographic plates. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

It is hardly necessary to say that this text-book, containing as it does, articles by several of the most eminent surgeons of England and the United States, represents much of what is really the best modern surgery. Those sections which have been written by men who have made the special branch treated, their life-

work, are naturally the ones most worth consulting. The article by Drs. Bull and Coley, for example, presents hernia as thoroughly as could be desired, and without giving up many pages to the consideration of trusses, a mistake too often seen in some of the more recent monographs on this subject. Further, in cases where the operation, originally described by any surgeon has been, in the course of time, materially modified, due note of the fact has been made. The simplification of Dr. Halsted's original operation for hernia is thus duly noted. Appendicitis, as might be expected, is treated by Dr. McBurney, and the chapter is one of the best in the book. The advances made by American surgeons are nowhere better illustrated than in the treatment of this affection. Two of the sections by English surgeons deserve special attention. Few portions of the book are so readable as Mr. Pearce Gould's section on the Surgery of the Neck, particularly because it lays so much stress on the embryological factors concerned in this region. His descriptions are clear, and his operative measures thorough. Mr. Bland Sutton, in forty pages, gives a remarkably concise account of Tumors, although Carcinoma can hardly be said to receive adequate attention, even in general terms, with less than five pages devoted to it.

Neither the article on Prostatic, nor that on Ureteral Surgery, contain an adequate account of the recent advances in those branches. Bottini's operation is barely mentioned, nothing being said as to the results obtained with it, or of the methods of procedure. In the section on the Surgery of the Nose, no mention is made of the methods of Paraffin injection for the restoration of deformity.

The chapter on diseases of the Lymphatic System is a disappointment. The statement at the very outset, for example, that "the peritoneum, the pleuræ, and the joints . . . are in direct communication with the lymphatic vessels, and may be regarded as reservoirs of the lymph," causes no little surprise in view of the recent pretty conclusive demonstration that the lymphatic vessels, like the blood-vessels, form a completely closed system, and that there is no such direct communication between them and the peritoneum, for example, as has been hitherto believed to exist. Although mention is made of the danger of wounding the thoracic duct in neck operations, we are not told just where to look for that vessel. The possible lesions of the spleen are enumerated, but their symptoms are scarcely referred to, and no mention is made of differential diagnosis.

In spite of the minor defects mentioned, this text-book probably covers the necessary ground as well as any available in English, of the same size.

Atlas and Epitome of Diseases of the Mouth, Pharynx and Nose. By DR. L. GRÜNWALD, of Munich. Edited by JAMES E. NEWCOMB. (*Philadelphia: W. B. Saunders & Co., 1903.*)

Grünwald's treatise deserves a prominent place among the many works now appearing on the nose and throat. It represents the result of many years of careful observation and contains the results of much individual work. The work is divided into two parts; the first consisting of a series of colored plates, the second a brief but comprehensive review of the diseases of the nose and throat.

The plates are well selected and comprise the diseases commonly seen. The description of the lesions, together with the short history of each case, makes them quite clear. The drawings also are very well reproduced.

The second part of the work is to be especially commended. Much of the work is original with the author, such as the chapter on focal diseases of the nose which seems an epitome of his book on "Nasal Suppurations." The chapter on mouth breathing is interestingly written. The relation of mouth breathing to certain so-called neuroses as pavor nocturnus, nocturnal incontinence and some cases of epilepsy is referred to. The inflammations and hyperplasias of the pharyngeal lymphatic ring receive good treatment in the appendix. The author emphasizes the importance of these structures as a "*locus minoris resistentiæ*" for the entrance of pathogenic microorganisms, which cause widespread inflammations in the body, as in the serous membranes, the joints and bones.

A Text-Book of Anatomy by American Authors. Edited by F. H. GERRISH, M. D., Professor of Anatomy in the Medical School of Maine Bowdoin College. Second Edition. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

This text aims to fill a place "between the extremes represented on the one hand by pocket manuals with their flavorless condensation, and on the other hand by encyclopedias of universal inclusiveness" (Gerrish, p. 5).

In other words the authors modestly place before us an "elementary work on anatomy" (Gerrish, p. 57). and as such the work is a success. The text is well and clearly written. The illustrations, which are good, are largely from the French anatomy, Testut. The relation of muscles to skeletal attachments illustrated diagrammatically is one of the most valuable and suggestive features of the work, and should prove a great aid to the student in making free-hand drawings on outline charts, such as are being used in our leading medical schools in America. In Germany such drawings have constituted a valuable part of the student's work for some years.

Many of the diagrams are excellent. The engraving of names of parts directly upon them is very commendable. The areas of muscular attachments to the bones, illustrated in the chapter on "Osteology" is a good feature of the work.

Since five of the six authors are or have been surgeons, it is not surprising that unusual attention has been given to surface, relational, and surgical anatomy.

In 1895, in Basel, an anatomical nomenclature was adopted by a body of the best anatomists of the world. These terms, the Basel Nomina Anatomica, [B NA] seem destined rapidly to become international. They have been employed in revising old German texts. The new atlases of Spalteholz and Toldt have incorporated them, and their introduction into our leading American colleges, together with the translation of Spalteholz, is rapidly bringing these terms into use in America. The adoption of this nomenclature in the part on the "Cerebro-Spinal Axis" would have rendered this clearly written chapter to a much greater degree a preparation for more extensive works and won for the book a much more favorable recognition in Europe.

The authors have not aimed at completeness nor at great detail in description, but with the possible exception just mentioned, they have accomplished well their avowed purpose, that of presenting an elementary text-book of anatomy.

B. D. M.

Golden Rules of Refraction. By ERNEST E. MADDOX, M. D., F. R. C. S. Ed. Golden Rule Series No. XII. (*Bristol: John Wright & Co.*)

This book, like its predecessors, contains much information in a small compass. It is intended to give general practitioners who are commencing the study of refraction, a general conception of the work before them. We are gratified to see that the author recommends bifocal glasses to all persons who might otherwise be compelled to use two sets of spectacles. We are also gratified to learn that they were invented by Benjamin Franklin and popularized by Sir Joshua Reynolds.

The Story of a Living Temple. A Study of the Human Body. By FREDERICK M. ROSSITER, B. S., M. D., and MARY HENRY ROSSITER, A. M. (*Chicago, New York, Toronto: Fleming H. Revell Company, 1902.*)

This attractively printed and thoroughly well-intentioned volume is a distressing instance of an overworked metaphor. Starting out with the scripure text, "Know ye not that ye are the temple of God, and that the spirit of God dwelleth in you? If any man defile the temple of God, him shall God destroy; for the temple of God is holy, which temple ye are," thirty-eight chapters follow devoted wholly to an elaboration of the different phases of this simile. The titles of the chapters are often highly imaginative, such as "The Wonders of the Temple," "How the Wall of the Temple Can be a Living Wall," "The Breathing Rooms" (the lungs), "Winking Valves and Living Pumps (the alimentary canal), etc. The book displays much careful work and is imbued with a strong religious tone. It is popular rather than scientific.

A Treatise on Diseases of the Anus, Rectum, and Pelvic Colon. By JAMES P. TUTTLE, A. M., M. D., Professor of Rectal Surgery in the New York Polyclinic Medical School and Hospital; Visiting Surgeon to the Almshouse and Workhouse Hospitals. (*New York: D. Appleton & Co., 1902.*)

From the point of view of extensive personal observations, of the record of others' work, of arrangement, and of illustration, Dr. Tuttle's book practically attains to the modern ideal of a perfect text-book.

In an introductory chapter, the anatomy of the rectum is well described, the cuts illustrating the anatomical divisions being particularly clear.

Of the many excellent sections in the book, special reference may be made to those on Tuberculosis, on Fistula and on Hæmorrhoids. There is an interesting note on Hyperplastic Tuberculous Colitis, that peculiar form of the disease which has recently been brought to general notice, especially by the French writers. The chapters on Fistula, together with that on Perirectal Abscess, are perhaps the best in the book. The illustrations in this section are unusually good, showing most clearly the varieties of fistulous tracts, and the essentials for treatment. It is interesting to note that 50 per cent of the fistulas seen by Dr. Tuttle were in persons, either at the time, or later, affected with tuberculosis.

The thorough chapter on Hæmorrhoids ends with Dr. Tuttle's conclusion that "on account of its applicability, the ease and celerity with which it can be applied, and its uniformly good results, the clamp and cautery easily stands first among the operations for hæmorrhoids."

The only illustrations in the book that are unsatisfactory, are the microscopical drawings of carcinoma and sarcoma of the rectum.

The brief section on Rectal Feeding, which includes a number of appropriate formulæ, ought to be very useful.

Throughout the book, operative measures are very fully described, all the leading methods being given in detail, and followed by a careful weighing of the facts for or against a given procedure. This is well illustrated in the section on operations for excision of the rectum, where the steps in the evolution of the operation now generally done, are shown by a series of cuts.

No one interested in this branch of surgery can afford to be without this book.

A Manual of Medical Treatment or Clinical Therapeutics. By I. BURNEY YEO, M. D., F. R. C. P. Two volumes. 10th edition. (*Chicago: W. T. Keener & Co., 1902.*)

To the student who is taught throughout his course that diagnosis is the chief end of the medical man, and who has, nevertheless, an instinctive feeling that when he is actually in practice, he will be expected to treat sick people, Dr. Yeo's book is a great blessing. It is probably the most acceptable work of its kind, largely because treatment is approached from the point of view of the disease and not from that of the drug. The care of the successive stages of a disease is described in detail. This is well illustrated in the section on dysentery and on bronchitis, where each indication and its appropriate treatment are fully outlined.

Dr. Yeo is evidently a polypharmacist, providing a remedy for every symptom, and often recommending heavy formulæ, a tendency from which American physicians are slowly getting away. As is so customary in England, the dose of nearly every mixture is a tablespoonful.

Sixteen pages are devoted to the antiseptic treatment of tuberculosis. Aside from the prevalent disbelief in this, the very fact that good observers get such widely divergent results with the same drug, proves the inefficacy of most of them. One is surprised to note the emphasis on the use of styptics in hæmoptysis, when it is borne in mind that the researches of Bradford, Dean and Andrews have shown that these, by raising the pressure in the pulmonary circulation, may actually increase the tendency to hæmorrhage.

In the treatment of typhoid fever and of appendicitis, the American physician will probably disagree with Dr. Yeo. The antiseptic treatment of typhoid, now so generally acknowledged to be unavailing, is still warmly advocated by Dr. Yeo. Although he expresses surprise that any of his favorite "Chlorine Mixture" should reach the intestine, he still advocates its use on empirical grounds, and even suggests that some of it is absorbed into the blood. Further, without a word as to the tonic effect of the cold bath treatment, three pages are given to the criticism of this method as a routine, although acknowledgment is made that the author has had no opportunity to test the value of the statistics adduced in its favor. No mention is made of calcium chloride in the hæmorrhage of typhoid, a heavy gallic acid mixture being suggested instead.

Dr. Yeo shares the general English conservatism as to the treatment of appendicitis, believing that it is regularly possible to recognize the cases which require operative measures early. He recommends opium in the acute suppurative form in spite of the repeated plea from the surgeons against it on account of its masking the symptoms. Aperients are advocated for "mild" attacks.

Dr. Yeo's book may be recommended to every one who wishes to treat disease intelligently and thoroughly. It is well arranged and well indexed, and due credit is given to every author whose ideas are quoted.

Biographic Clinics. The Origin of the Ill-health of De Quincey, Carlyle, Darwin, Huxley and Browning. By GEORGE M. GOULD, M. D., Editor of American Medicine. (*Philadelphia: P. Blakiston's Son & Co., 1012 Walnut St., 1903.*)

The thesis of this attractive volume is that the five men whose names are mentioned upon the title page suffered from eye-strain and consequent neurasthenic symptoms. As no mention was ever made of the presence of this condition by their biographers or any record of an examination into the actual refractive defect by a competent oculist exists, it is of course necessary that the author should gather his information from such biographic details as have been given in their published letters. From the abundant evidence which he obtains as to their sufferings whenever they were compelled to use their eyes continuously he infers with every shadow of reason that they all suffered from eye-strain in consequence of their severe studies or excessive literary labors. If, in addition, an error of refraction had been demonstrated in each individual case considered, the strength of the argument would have been increased. Enough, however, seems to have

been gathered to render the truth of the contention extremely probable even if actual proof is not presented.

The true value of the book, however, lies in the concluding chapters on "Biliousness and Headache," "Some Neglected Points in the Physiology of Vision," and "Astigmatism and Eye-Strain." These we commend to every neurologist for careful and thoughtful study. The author writes earnestly and forcibly, as he always does, and his facts and arguments are most weighty.

Diseases of the Pancreas and their Surgical Treatment. By A. W. MAYO ROBSON, F. R. C. S., Senior Surgeon, Leeds General Infirmary, and B. G. MOYNIHAN, M. S. (Lond.), F. R. C. S., Assistant Surgeon, Leeds General Infirmary. (*Philadelphia and London: W. B. Saunders and Company, 1903.*)

The interest at present accorded to disease of the pancreas is shown by the frequency with which this subject has been recently assigned for the discussion of various medical associations. The coming Congress of American Physicians and Surgeons will give an entire session to the subject. Further evidence of this interest is furnished by the work of Mayo Robson and Moynihan devoted particularly to the surgical aspect of diseases of the pancreas. The book, which is printed in attractive form, is dedicated to the surgeons of America.

A chapter is given to the anatomy of the gland and is followed by a review of the experimental and in part clinical studies undertaken to establish the relation of the organ to carbohydrate metabolism. Throughout the work the authors have made use of the abundant clinical material which has come under their own observation, and at the same time cite numerous cases from the abundant literature of pancreatic disease. The relation of chronic pancreatitis to cholelithiasis has received especial attention. Mayo Robson has in previous publications emphasized the frequency with which gall stones in the common duct are associated with such induration of the pancreas that the diagnosis of malignant disease is made at operation. In twenty-four cases in which this condition was recognized all save one recovered. It seems that the writers give undue importance to the symptomatology and treatment of the associated chronic interstitial pancreatitis, which in great part at least are those of the primary cholelithiasis.

It is unfortunate that the term subacute has been introduced into the classification of inflammations affecting the gland. The classical terms, suppurative pancreatitis, hæmorrhagic pancreatitis, and gangrenous pancreatitis, a late stage of the hæmorrhagic lesion, represent well defined pathological changes. The term subacute has been used to designate those cases which do not terminate fatally within a few days and is not applicable to any readily definable lesion.

The book in large measure fulfils the purpose of the writers to review the work of the past and to point out the need of further advance.

Atlas and Epitome of Human Histology and Microscopic Anatomy. By PRIVATDOCENT DR. J. SOBOTTA, of Wurzburg. Edited, with additions, by G. CARL HUBER, M. D., Junior Professor of Anatomy and Histology, and Director of the Histological Laboratory, University of Michigan, Ann Arbor. With 214 colored figures on 80 plates, 68 text-illustrations, and 248 pages of text. Cloth, $4.50 net. (*Philadelphia and London: W. B. Saunders & Co., 1903.*)

The illustrations in this work represent, with few exceptions, sections of various organs of the human body. Unusual care was used in making the drawings. The preparations were photographed, from the photographs outline drawings were traced on tracing-paper and then transferred to drawing paper, and then the drawings were finished from a direct study of the sections. In this way various details were accurately portrayed. Nearly all the illustrations in the volume were made under relatively low magnifications, such as are used by the majority of students in the general microscopic courses. Since most of the preparations were made from human tissues obtained from individuals who had been executed, and the illustrations, both the colored and the black and white, are clear and accurate, the atlas offers a ready means of getting a good idea of the appearance of normal human tissues, hardened, sectioned and stained. It is therefore likely to be of especial advantage to those who find it difficult to get first-rate specimens of normal human tissues.

As an aid to the student in getting a good conception of the finer structure of the body, the atlas will be found lacking in several important particulars. Very few illustrations of teased preparations are given. Diagrams are infrequent, although several excellent ones of the salivary glands and pancreas show their value. No attempt is made to illustrate by means of reconstructions or dissections the third dimension. It is essentially a two-dimension histology.

The text is clear, concise and as accurate as one could well find where brevity enforces dogmatism. No references to the literature are given. The English of the translation is smooth and pleasant. The additions which the editor of the translation has made are of such value that one wishes he had used his hand more freely.

C. R. B.

How to Succeed in the Practice of Medicine. By JOSEPH MCDOWELL MATHEWS, M. D., LL. D. (*Louisville: John P. Morton Company, 1902.*)

This book has an eye single to business and aims to inform the young physician as to the personal side of the practice of medicine, that is, how he should conduct himself so as to attain professional success. This success is not of a large sort; it is pecuniary success rather than scientific achievement. The volume is marred by many rather pointless tales and anecdotes and "to relieve the monotony," we are told by the author, "a jocular vein is interspersed here and there." It is also rendered extremely tedious by attempts at fine writing. The words "home" and "wife" always seem to set the author off and he goes on indefinitely after this fashion: "A beautiful woman—the Creator's most perfect handiwork! The attempt of the artist to catch the rich coloring of her cheeks, the depth of her great blue eyes, the radiance of expression, the turn of lip, the taper of fingers and the luster of her hair is futile, and his brush falls to the ground in utter ignominy. To paraphrase: 'God possibly could have made a more beautiful thing than a beautiful woman but he never did.' Think of her power. A man will go on bended knee to her; the clasp of her hand can drive him mad, and to touch her lips he would sacrifice wealth and honor. Madness, despair, drunkenness and sorrow go in her wake, for men would creep in mire and filth to do her command. The history of the world recites more than one Anthony and Cleopatra, and thousands have gone to their death by drink, by opiate and by the pistol shot as the result of her presence and influence. No, not alone for beauty of face, but rather beauty of character, should you select the one who is to share your burdens as well as your joys. One possessed of natural grace, of comely appearance, of health; whose disposition is as charming as her traits; whose laughter is contagious. One whom men speak well of and women praise. Educated, refined and of quick perception, not given to gossip or an evil tongue; one who believes that 'this is a beautiful world and filled with pleasant people,' one who knows not cant, hypocrisy or deceit and whose manner is that of the perfect lady. Take her, for she will be an honor to you and her glory will be everlasting."

The advice given in the book is sensible, and the writer shows much familiarity with practical matters. It is attractively printed

and would be readable if it were written in a less sentimental vein.

Physiology at Harvard. By WILLIAM TOWNSEND PORTER, M. D., Associate Professor Physiology, Harvard Medical School. Second edition. (*Cambridge, Mass.: The University Press, 1903.*)

The object of the work is clearly and concisely stated in the preface, which is as follows:

"This book is written to explain a new method of teaching, sound in theory and feasible in practice; to provide the Harvard Medical School with a precise account of the work done by each student in Physiology; and to create for students and instructors alike a working-plan by which they may find their way unvexed through much detail."

The "new method" is designed to make of the student an observer rather than a listener, to teach him to seek evidence not authority, to study nature not books.

The means for achieving these results, in other words, the "new method" itself consists essentially of the following factors:

1. *Laboratory Work.*—This forms the most important part of the course and is supplemented by frequent "conferences" (or informal recitations) and written tests. The number of experiments performed by the student is very considerable and at the end of the course he is required to pass a practical examination. An interesting feature is the substitution for the usual "laboratory guide" of *printed accounts of the experiments as originally performed.*

2. *Demonstrations.*—These are given weekly to small groups of students.

3. *Recitations, &c.*—The student's work is correlated and systematized by means of conferences and recitations which are didactic in character, being "in no sense examinations"; such lectures as are given are merely explanatory of the laboratory work.

4. *Theses.*—Each student is required to write a thesis on a topic assigned to him and for which he is provided with a bibliography. The best of these theses are read and discussed in class.

The educational value of the various factors which make up the "new method" cannot be questioned, and that they are well adapted to the end in view is obvious. But why the term new is employed is not altogether clear. Neither the object nor the factors impress one as being altogether novel. If it be the proportions in which the factors are mixed then this method is in a sense "new." But would it not be more appropriate to speak of it as the "Harvard method"?

Dr. Porter implies that the spirit of research and the desire to acquire knowledge first hand is a distinctive feature of the work at Harvard. When, however, such a spirit pervades the student body may it not be attributed to the personal influence of the teaching staff rather than to any educational agency such as the method in question?

Certain features of the Harvard method call for special comment.

1. It seems possible that there may be cases in which the lecture may have some advantage over what we may call the didactic recitation. It should not be forgotten that there are lecturers who are not automatic text-books, but living men full of a contagious zeal for science and experimentation. Again, there are perhaps as many teachers who cannot conduct a recitation properly as there are poor lecturers. Lastly, it may be urged that the value of the recitation varies inversely as the size of the class if not with the square of the size.

2. The advantage of preparing a thesis to the individual who writes it is certainly great, but may not the value to the class of listening to the reading and discussion of such theses be questioned?

3. A large amount of laboratory work is of course very desirable, and those institutions in which such work is not already a special feature would do well to follow Harvard along a path made comparatively inexpensive by Dr. Porter's persistent efforts to lessen the cost of class apparatus.

To those engaged in the teaching of physiology a word from one of our foremost medical schools is always welcome, and it might be equally helpful if one or more of the other great laboratories of this country would provide us with an equally complete account of the ways in which they are solving the ever present problem of instruction in physiology. D.

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SERIES I-II-III.

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THE HISTORY OF ST. BARTHOLOMEW'S HOSPITAL, LONDON.*

By Thomas McCrae, M. B., M. R. C. P. (Lond.),

Associate in Medicine, The Johns Hopkins University, and Resident Physician, The Johns Hopkins Hospital.

At the opening of this hospital in 1889, during the course of his address, President Gilman mentioned the gift of a volume from Dr. Norman Moore, then warden of St. Bartholomew's Hospital in London, with the inscription: "To the library of the newest of Hospitals this account of the progress of medicine in one of the oldest is given by Norman Moore with the earnest hope that the Johns Hopkins Hospital may flourish at least as long as the Royal Hospital of St. Bartholomew in Smithfield, and prove no less useful to mankind—on the opening day of the Johns Hopkins Hospital, 1889." It is the history of this older English hospital that is brought before the Society. One had almost said "the oldest," for it was founded in 1123, but the hospital in Chatham—also dedicated to St. Bartholomew—was founded some years before its namesake in London, probably between 1087 and 1100. In this paper there is nothing new to be presented, but only the gathering together of the records of others.[1]

To the casual visitor to London, and perhaps sometimes also to the medical visitor, St. Bartholomew's is but little known. Not standing directly on the great avenues of travel, few see the buildings except as a result of special search. They are in Smithfield, between Charterhouse and Newgate streets, and perhaps their neighboring buildings, the General Post Office and Christ Church and Hospital, may help to fix the locality. In the original foundation were two establishments, the priory and the hospital. Of the former the church still exists, St. Bartholomew the Great, which, excepting the chapel in the Tower, is the oldest church in London. Within the precincts of the hospital is the church of St. Bartholomew the Less, which is the hospital chapel. The name of St. Bartholomew was given to many hospitals founded in England during the twelfth century. Tradition states that the Apostle Bartholomew went to India, where he suffered martyrdom. Some assert that he was flayed alive and the figures of the Apostle are usually represented holding a knife in his hand. In the eleventh century some of the arm bones of the martyr were brought to England and many miraculous cures were attributed to the relics. From this probably came his choice as a patron saint for so many hospitals.

The Founder and the Foundation.

We have a surprisingly full account of both the life of the founder, Rahere, and the beginning of the hospital. This is contained in a manuscript in the British Museum called *Liber fundacionis ecclesie Sancti Bartholomei Londoniarum.*[2]

* Read before the Johns Hopkins Hospital Historical Society, March 11, 1902.

The writer of this manuscript was an Augustinian canon of the Priory of St. Bartholomew and it was apparently written in the priory. The manuscript is one of the "Cottonian" collection and is numbered "Vespasian B IX." This title was taken from the bust which surmounted the case in which the manuscript was kept. It fortunately escaped injury in a fire in 1771. There are two versions of the work, one in Latin, the other in English. Dr. Moore has carefully studied the evidence as to the date when these were written. The Latin version was probably composed in the reign of Henry II and between the years 1174 and 1189. The date is about forty years after the death of Rahere, the founder, and the writer mentions having talked with those who had known him. The writer himself was a canon under Thomas, the successor of Rahere as head of the priory. To him we owe the account of the foundation and the life of the founder as given in the Latin version. The English version was probably made about the year 1400. A copy of the Latin version was apparently made about the same time and it is this copy which is still preserved.

The Book of the Foundation is divided into two parts and each of these is subdivided into chapters. It gives first some account of the life of the founder, whose name is given variously as Rahere, Raherus, Rayhere and Rayer. He is usually spoken of as a jester or minstrel at the court of Henry I. His biographer mentions his origin, saying he was "boryn of lowe lygne," and then comments on his life at court. Here evidently he was a prominent figure in lighter affairs and "lede forth the besynesse of alle the day." In those times this was not incompatible with the occupation of an ecclesiastical office, for Rahere held a stall in St. Paul's Cathedral. In 1120 was the wreck of the White Ship and the loss of the heir to the throne. With this came a great change in the king and court. Whether Rahere wished to be in the fashion or whether he experienced a change of heart we can only guess, but about this time he resolved to mend his ways and lead a more devotional and useful life. To set a seal upon this he determined on a pilgrimage to Rome in the year 1120, "covetynge yn so grete a laboure to do the worthy fruites of penaunce." While in Rome he visited the scenes of the martyrdoms of St. Peter and St. Paul. After this he fell ill, possibly, as has been suggested, with malaria. To Rahere this seemed a judgment for his sins. He considered his end to be near, or as our narrator has said, "and demyd the last oure of oure of his deith drewe him nygh." Then "he schedde out as water his herte in the syght of God and albrake owte in terys, than he avowyd yf helthe God hym wolde grawnte . . . he wolde make and hospitale yn recreation of poure men, and to them so there i gaderid, necessaries mynyster after his power." This passage is noteworthy as showing from the first the intention in Rahere's mind of founding a *hospital*. With the stimulus of sickness upon him it is not strange that he should have thought of the means of relief to others. After this his recovery was rapid and he set out on his return to England to fulfill his vow. About this time he saw a vision, in which he was borne up by a beast and set on a high place from which he beheld a deep pit into which he seemed about to fall. To him who "for drede tremelyd and grate cryes of his moweth proceedyd" appeared the figure of St. Bartholomew. The apostle comforted him and commanded him to found a church in Smithfield in London which would be under his protection and was to bear his name. Rahere doubted the vision at first, but on deliberation determined that he had received a commandment to be obeyed. This account shows us the intention to found first a hospital and second a church, both of which Rahere was enabled to do. It doubtless gives us the opinion then current in the priory as to Rahere's early ideas.

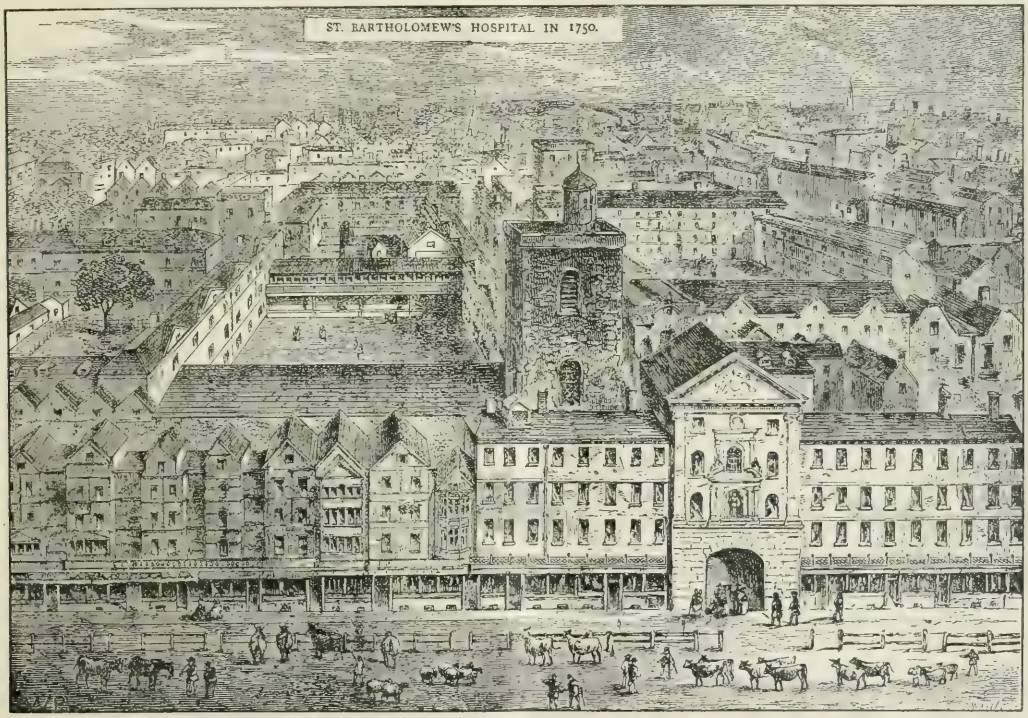
After his return to London he related the story of the vision and set about the fulfilling of his vow. To this end the interest of the King was all-important, and in gaining this he was aided by "Bisshoppe Richarde," who was Richard de Belmeis, Bishop of London. The King listened favorably to Rahere's request. The change in his character after the death of his son may have made him more inclined to good works. Rahere was given a grant of land in Smithfield which was outside the city walls. Here he founded the hospital and church in the year 1123. The location promised little, for the scribe states, "it pretended noone hope of goodnesse." A portion of it was a marsh and the higher part was the scene of hangings and of tortures given to criminals. It is termed "a Golgotha, the place of open abhominacion." In view of the difficulties such as these one sees little basis for the accusations of insincerity sometimes made against Rahere. It has always to be kept in mind that there were two parts to the foundation, the priory and the hospital. The purpose of the latter is given as "for poor diseased persons till they got well, for women with child until delivered, and for the maintenance of the children born there until the age of seven, if their mothers die in the hospital."

The date of the foundation is given and the names of the prelates of the day which serve to fix the time beyond doubt. The chronicle says, "The chirche he made of ceemly stonewerke tabylwyse and was an hospital howse a litile longer of." At this time Rahere was the victom of envy and malice; plots even were made against his life. He apparently applied to the King for protection and a charter was given which secured for the foundation the rights of the crown.[3] The date of this is 1133 and both the church and the hospital are specified. Copies of it made in the reign of Henry VI are still extant and at that time, Dr. Moore states, the original was produced in a court of law.

The Book of the Foundation then gives the accounts of many cures wrought at the shrine. Nearly all of these are ascribed to miraculous healing and the influence of the saint. They were apparently done at the church. Yet there were evidently patients in the hospital, as there is a reference to one whose duty it was "to seke and provyde necessaries to the nede of the poer men, that lay in the hospitall." The expression "poor" might suggest that it was more of an almshouse than a hospital, but this mode of reference to the patients is very common and in the seventeenth century

was frequently used. The first case in which specific mention is made of admission to the hospital may be quoted at some length. It may be said to be the first case record of the hospital. Many of the cases since then have not been described as fully as this one of the twelfth century. The account is given in Capitulum XXVIII of the first book. The history in part is as follows: "An nothir man Alfunyne by name in the towne of Dunwych, that dwellid on the see syde, so was contracte that he myghte not use the free office, nethir of hande, ne of fote, his legges were clevynge membrys used thyr naturall myghte he followid yn greater workys, hewyrrys of wode with axe and squarerys of tymbyr with chippynge axe and nat longe aftir the crafte of carpentyre. . . ." From which we may judge that his restoration to health was complete. To make a positive diagnosis now would be difficult; his condition may have followed an acute illness or it may have been due to a neurosis. In any case the removal to new surroundings with confidence in the outcome had great influence on the result.

The second portion of the book opens with a prologue in



to the hynde parte of his thyes, that he myghte nat goo, and his handis turnyd bakewarde, no thynge with them myght he do, ne worke: the extremyteis of his fyngers were so rigorisly contracte in the sinowys, that he myght unneith put mete to his moweth. In this grevous sykenes he passid his yonge age. . . . Therefore for that he was ferre from that chirche he yave shipmen for hyr hyyr and by shippe he was browght to the chirche, and put in the hospitall of pore men. . . . And he began yn the meyn while, by the vertu of the apostle to take breith into hym and he desired helth by certeyn incrementys began to come ageyn: ffirst with handys thow they were crokyd, he dyd make smal workys as disstafes . . . and furthermore by succession, whan othir which Rahere's death in 1144 is mentioned. The scribe says, "the cley howse of thys worlde he forsoke and the howse everlastynge he enterr'd." At his death Rahere commended his little flock, "with little land and right few rents" to the care of St. Bartholomew. The name of his successor is given "Thomas oone of the chanonns of the church of Seynt Osyth," of whom, after his long term of office of thirty years, it is said, "he decessid and was put to his fadres." Then follows the account of many miracles done by the influence of the saint. Many of these are of miraculous healing and resemble the case quoted before. They are generally characterized by paralysis, wasting and contractures. Some are evidently cases of hysteria thought to be instances of de-

moniacal possession. In only one instance is mention made of a stay in the hospital.

The church of the priory (St. Bartholomew the Great) has existed until the present day, although only parts of the original are still preserved. The site of the priory is now covered by houses. The adjoining district of Smithfield, as noted by the scribe, was the scene of executions before Tyburn. Here William Wallace was beheaded in 1305. Wat Tyler was probably slain near the hospital in 1381. During the religious persecutions of the reign of Mary many were burned at the stake. Neighboring ground is also said to have been used for tournaments and doubtless the proximity of the hospital was convenient for the dressing of the wounds. Here, too, the great Bartholomew Fair was held. This was probably first held before 1133, for in the charter granted by Henry I in that year, reference is made to the custom of holding the fair. This charter also gave immunity to arrest for three days to all those who were attending the fair. At one time it was the great cloth fair of the kingdom, although goods of all kinds were sold. In 1691 it was shortened from fourteen to four days. At first held altogether for business, it gradually acquired more and more features which served only for amusement. These degenerated and ultimately the fair was regarded as a time of great license. In 1844 the fair was removed to Islington and in 1855 came to an end.

The Hospital.

From 1123 until the present the hospital has stood on the same spot and with the exception of a short period in the reign of Henry VIII its doors have always been open. So far as the records which are available show we have little information regarding the hospital in its earlier days additional to that contained in the account of its foundation. The original hospital had eight brethren and four sisters; they elected a head who was called the master. He and the brethren had to swear obedience to the prior of St. Bartholomew's Church and were required to render an account of their income and expenditure to him. The enclosure at first probably contained the hospital buildings proper, but gradually others were added. Chapels with lodgings for the chaplains and other buildings were collected about. Later some of these houses were rented to outsiders. At one time the medical attendants occupied houses in the hospital grounds. This custom exists in some of the London hospitals to-day, quite apart from the usual resident staff.

As already stated, Henry II confirmed the rights of the hospital by a charter in 1133. King John about 1204 also issued regulations regarding the hospital and priory. In these the hospital is made subject to the rule of the priory. It is stated that the deed endowing the hospital is not recorded, so that the nature of the endowment is not known. In 1223 and 1224 we have the record of a gift from Henry III to the hospital:

"The King to Engelard de Cigoyny greeting. We command you to give to the patients of the Hospital of St. Bartholomew in London as our gift, one old oak in our forest of Windsor on the Thames, with the least possible injury to our forest and the greatest use to the aforesaid patients for their hearth."

Various citizens of London seem to have aided the hospital, among whom was Henry Fitz Elwin, the first mayor. In 1226 the Earl of Salisbury, one of the witnesses of the Magna Charta, left a donation in his will. In 1230 some of the hospital lands in Essex were exempted from taxation. There are records of many additions to the endowment in the succeeding years. Thus in the reign of Edward II there is a grant of "thirty seven acres of land in St. Giles and St. Botolph without Aldgate in aid of the support of the poor and infirm in the said hospital." Of the endowment about the middle of the fifteenth century we have full records. These are the work of John Cok, who was a brother of the hospital. He was the renter of the hospital and in the years after 1456 he wrote full accounts of the property, which are still preserved. In the reign of Henry II (1422-1461) Parliament allowed the priory to depute to the master of the hospital the carrying out of repairs to the water supply from their aqueduct in Iseldon. One-half of the water, which was conveyed in pipes, was to be given to the hospital, for which a rental of 6s. 8d. was to be paid. By the time of Henry VIII the rents of the hospital from the endowment are stated to have amounted to about 370 pounds sterling, from which various payments amounting to 66 pounds had to be deducted. During this period but little change apparently occurred. The endowment gradually increased, which one might wish were more common at the present day. There had been other similar institutions founded, St. Thomas Hospital in 1213 and Christ's Hospital soon after. Bethlem, which was "an hospital for distracted people," was founded in 1247.

There is little to note about this period until in the reign of Henry VIII, when, along with other religious foundations, the Act of Dissolution in 1536 closed the doors. So far as found there is no definite record of the process, whether the patients were all turned out of doors at once or the hospital gradually emptied by the stopping of further admissions. From the general drastic character of the proceedings at that time, we may suppose that no great consideration was shown. The Priory was bought by the Attorney-General, but there is no record of any sale of the hospital or its endowment. It remained in the possession of the Crown. The hospital may have been plundered, however, for the library disappeared either now or shortly after, and in a petition from the citizens of London a short time later mention was made of the fact that nearly all the furniture had been carried away. One can hardly imagine what the closing of the hospitals must have meant. To-day it would be a calamity; then it was certainly no less. The condition of affairs became intolerable and it was not long before steps were taken to remedy the existing conditions. This action was taken by the civic government. So in 1538—two years after the closing of the hospitals—we find the mayor, aldermen and citizens

petitioning Henry VIII that he would grant to the mayor and his brethren or to such other as should stand most in his gracious favor, the rule of the three "hospytalls or spytells called Saint Mary Spytell, Saynt Bartylmewes Spytell and Saynt Thomas Spytell," for the relief of the poor and needy. But they evidently had in mind the practical administration of the hospitals if the request was granted, for they were careful to ask for the rents and revenues as well. In the petition to the King the evils of the lack of hospitals are pointed out and they refer to "the myserable people lyeing in the streete offendyng every clene person passyng by the way w^t^ theyre fylthye and nastye savors." Then, too, they say that many of these sick have resorted to the parish churches. The explanation of this complaint is of interest. The larger churches had a portion of the building set apart for the sick—probably especially for the lepers—so that they might not come in contact with the general congregation. These special places can still be seen in many of the old churches. But with this provision in the larger churches in London, the smaller parish churches had neglected such arrangements for the sick, and so when the larger ones were closed, the sick folk went to the parish churches where they mixed with the congregation to the no small danger of infection. Consequently the citizens prayed that the churches might be reopened as well as the hospitals—a plea for both the spiritual and bodily welfare of the community.

Too often do such petitions fall upon deaf ears and this was no exception. Apparently the King took no notice of the citizens' request. Subsequently, however, whether they succeeded because of their importunity or whether the conditions became intolerable, we find the petition granted in 1644 and letters patent issued re-establishing the hospital. This was eight years after the Act of Dissolution. The King restored the site of the hospital, with the rights and privileges as they had been vested in John Brereton, the last master. The greater part of the endowment, however, was not restored. The document reads that "we determine to create erect found and establish a certain hospital," and this may have given rise to the statement sometimes made that St. Bartholomew's Hospital was established by Henry VIII. The regulations for the new establishment were modelled on those of the old. There was to be a master and four chaplains, all of whom were to be "priests." The fourth chaplain was to be the visitor to the prisoners in Newgate. The appointments were undoubtedly given as rewards, and, as Dr. Moore points out, were probably made to yield as much as possible. The new officers may have sold the library. They may also have profited by the fact that there was freedom from arrest within the hospital. This had been granted by Edward II. It is worthy of note that this was tested in 1541, at the time when the hospital, as such, was closed. In that year an arrest was made in the hospital. A protest was made to the mayor and we find that the arrest was "dyscharged."

The citizens had petitioned for the restoration of the endowment many years before and they doubtless saw that to have a hospital without any funds was not a complete solution of their difficulties. We may suppose that they in no way neglected to improve this state of affairs, for in 1546 the King gave a yearly grant of 500 marks derived from certain property, in consideration of the citizens contributing an equal amount. (The mark was equivalent to 13 shillings.) This was quite inadequate and doubtless there were representations to this effect, for in 1547 we find that nearly all the former endowment was restored. In the same year a tax for the maintenance of the hospital was ordered by the city. The site of the hospital was made a parish. An attempt was made to give the hospital a new name and it is referred to as "the House of the poor in West Smithfield, near London, of the foundation of Henry VIII." This was not generally adopted and the hospital continued to be known by its former name. In return for these grants from the Crown, the mayor and citizens bound themselves to provide for one hundred poor men and women in St. Bartholomew's Hospital. The regulations also state specifically the full hospital staff. This was to consist of thirty-two people, among whom there were only one physician and one surgeon. There were to be eight beadles whose duty it was to bring the sick to the hospital and also chastise all vagabonds and beggars whom they might find. The nursing staff was to consist of a matron and twelve assistants. In 1548 and 1549 a new system of government of the hospital was introduced. The Council ordered that four aldermen and eight commoners were to be the governors. They were to be elected by the mayor and aldermen, half to be appointed every year and to serve for two years. When one reflects, it seems an unusual thing to see an institution which in 1536 was a religious foundation, managed no one knows how, under the direct control of the city government in 1548. There can be no reason to doubt that the change brought increased usefulness to the hospital. As time went on, the new governing body appointed others to be governors, chiefly from among those who had been benefactors and friends of the hospital. These became more numerous until in time the municipal corporation ceased to take a leading part in the management. This gradual change will be described later.

From this time on we have careful records of the hospital affairs. The expenses of administration at that time may be noted. For 1552 it was estimated that the fixed expenses would amount to 798 pounds and for uncertain items, which in 1551 had amounted to 60 pounds, probably 100 pounds would have to be allowed. In 1553 the hospital published a most interesting document called "Orders and Ordinances for the better government of the Hospital of Bartholomew the lesse." This is a statement to the public of the condition of the hospital affairs and of the methods of management and administration. As an example of the internal economy of a hospital of that time it is well worth reading. The "orders" begin with a preface to the reader in which the recent history of the hospital is reviewed. The writer begins with some generalities. "The wickedness of report at this day, Good Reader, is grown to such ranckness that nothing almost is able to defend it selfe against the venime thereof." He then recounts the steps taken to re-establish the hospital

and mentions the yearly allowance of 500 marks from the King, which was gladly received by the citizens, "Thinking it for their parts rather too little than enough." But on investigation they found the raising of the King's donation "to lye onely in a certain of houses, some in great decay and some rotten ruinous." Then in the hospital itself they found only "so much of household implements and stuffe toward the succouring of this hundred poor (which the city agreed to provide for) as sufficed for three or four patients." However, the citizens raised not only their 500 marks but in addition over 1000 pounds, which enabled them to provide for nearly one hundred sick. Good intentions are too often misunderstood and so we hear that "certain busie bodies more ready to espy occasion how to blame other, than skilfule how to redress things blameworthy, indeed, yea, I fear me having all their zeal in their tongue onely," have slandered the good citizens and poisoned the minds of the preachers against them. These preachers wrongly made public the backbiters' slanders and the citizens for their work received "an open detraction." Yet in the five years since the hospital was reopened "there have been healed of the Pocks, Fistulaes, filthy Blains and Sores to the number of eight hundred and thence safe delivered that others having need might enter in their room. Beside eight score and twelve, that have there forsaken this life, which else might have dyed and stunck in the eyes and noses of the City." Instead of praise slander has come, yet the citizens have been silent, looking for their reward in heaven. Such results speak for the good administration of the hospital; the slanderers ought to repent, but as they may not, the Lord Mayor now publishes the orders for the hospital both to stop the slander and let all men know how the hospital is administered. If further reform is needed the governors will gladly adopt it.

The regulations open with a list of the officers and a recital of the duties of the governors. The installation of newly elected members was an impressive ceremony. To them a solemn charge was delivered, from which one part may be quoted. "For truly ye cannot be blameless before God, if after ye have set hand to this good plough and promised your diligence to the poor, ye shall contrarywise turn your head backward." Then the new members were duly received into fellowship, after which all dined together, "every man at his own cost and charge." The duties of the various officers are then set forth. From the governors four surveyors were appointed who had the oversight of the property, leases, rents, etc., and four almoners who were a sort of house committee with discretion over the internal affairs of the hospital. There were two scrutiners who audited the accounts and are charged as follows: "Ye shall be ready and diligent to make search and enquiry from time to time for all such Gifts, Legacies and bequests, as have been or shall be given or bequeathed to the succor and comfort of the poor of this house." This is good evidence of the laudable intention to allow no chance of revenue to be overlooked, especially as they were exhorted "to commend and set forth the good order of this house" when they chanced to meet "good, vertuous and wealthy men." None of the governors received any salary; their reward was to be that promised to all who help the poor. Then follow the duties of various other officials. These are given in minute detail. The Hospitaler, who seems to have been a sort of steward, among other duties was to see that every person applying for admission was to be seen by two of the chirurgians who decided if his disease was curable. They were specially enjoined not to admit any incurable cases and while attending to the physical infirmities they were also to exhort the patients regarding their spiritual welfare. The matron was to have charge of the sisters, who apparently were only in the wards during the day except in case of "the present danger of death or needfull succour of some poor person." That idleness might be avoided they were to be set at "spinning or some other manner of work." The sisters were to be in by seven o'clock in winter and nine o'clock in summer, and they are commanded that "so much as in you shall lye, ye shall avoid and shun the conversation and company of all men." The porter's duties were onerous. He kept the gate and was to deny admission to suspicious persons. He was to go through the wards in the evening, "see them in good order and cause them to say the appointed Prayers." To such as offended by swearing, abuse of the officials, or by refusing to go to bed at the appointed hour, "him shall ye punish (after once warning given) in the stocks" and later report to the almoners. The beadles were to patrol certain districts searching for the sick or diseased, keeping careful watch that no former patients were counterfeiting disease or begging and "if ye shall fortune to find any so doing, ye shall commit him or them to some Cage." The list of duties of nearly all the officers ends with this exhortation, "if ye perceive at any time anything done by any officer of this house or other person that shall maintain disorder or procure slander to this house, that ye then declare the same to some one or two of the governors of this house, and to none other person and *no further meddle therein.*" Lastly is a list of the various salaries and the form of "passport" given to the patients on discharge. These regulations are very definite; each man's duty was clearly set forth. One is impressed by the careful directions given for the keeping of the accounts and records. These are very thorough. One can only regret that equal care was not taken with the medical records. These orders probably served as a model for the regulations issued in 1557 for the four royal hospitals, St. Bartholomew's, Christ's, Bridewell and St. Thomas.

In 1644 we find a record of what may be called concerted action in dealing with the sick and vicious poor. They were all to be examined at Bridewell, the sick who were curable were to be sent to St. Bartholomew and St. Thomas Hospitals, the small children to Christ's Hospital and the "stout and sturdy rogues and vagabonds" were to be employed in Bridewell.

In the great fire of 1666 the hospital buildings escaped injury, but much of the hospital property was destroyed and the income reduced for some time.

The gradual evolution of the government of the hospital

was not brought about without some conflict of authority. Originally the control of the hospitals was directly in the hands of the city authorities. Gradually, however, the boards became more independent until at last they practically controlled the hospital administration. This, however, was finally noticed by the city and in 1697 a warning was sent to the hospital clerks that they had been remiss in not summoning the aldermen to their meetings, for "every alderman is a governor of every of the hospitals of this city." In 1709 the hospital petitioned for the payment of long arrears of the 500 marks per annum which Henry VIII had given. The court of chancery finally granted this. For some time after this matters seem to have gone on quietly, but in 1755 the city council again investigated their relationship to the hospitals and appointed a committeé to enquire into what rights the mayor and citizens had in the hospitals and whether such rights had been given up or taken away. Either the committee was very deliberate or the matter was much involved, for their report was not made until 1766, in which it was stated that the mayor and citizens had the sole power of governing these hospitals and that while innovations had crept in they did not affect this right. The authority of the governors was only derived from the civic government. Evidently after this there was much friction between the city authorities and the governors of the hospitals. The city obtained control of the financial matters as far as possible. In 1778 is a regulation that the box containing the hospital seal should have three locks, one key to be kept by the lord mayor, one by an alderman and one by a member of the council. The court of aldermen also resolved that "all business appertaining to the city and hospital seals" should be transacted by the common council. The result of this was soon seen, for in 1779 the clerks of the hospitals came with certain leases to be sealed, but this was refused and the matter referred to a committee. In the same year the clerks were ordered to submit their accounts to the common council. In 1780 and 1781 the council appointed incumbents to various livings which had before been in the gift of the hospitals. Thus to the vicarage of Little Wakering in Essex the governors of St. Bartholomew's Hospital appointed the Rev. Mr. Mossop, but the city council had given it to the Rev. Wm. Owen and sealed his presentation with the seal of the city. The frequent story of a conflict of authority can be read between the lines. The hospital had governed its own affairs for many years without any reference to the civic authorities, who awoke to the fact and enforced their rights, a proceeding doubtless resented by the governors. Such a conflict could not go on, and so in 1782 steps were taken to bring about an understanding. A committee was formed from both of the bodies concerned and they drew up an agreement which was adopted by Parliament in the same year. We find in connection with this that the thanks of the city council were given to "Mr. Alderman Crosby for his endeavor to bring about a reconciliation between the city and the acting governors of the royal hospitals." The act of 1782 provided for a certain number of governors to be appointed by the city, the others to be elected by the board itself from among the friends and benefactors of the hospital. This practically has been the constitution of the board of governors up to the present. This gradual evolution of the management of the hospital from the time of Henry VIII until near the close of the eighteenth century is of interest. It took time, some misunderstanding and friction before a final adjustment to best meet the needs of the hospital was reached.

The buildings have always stood upon the same site. For a long time there was a public thoroughfare through the hospital grounds. There was much trouble caused by people selling various articles and crowding the street. There were various orders issued for the regulation of this. The early part of the eighteenth century saw many of the London hospitals founded, such as Westminster, Guy's, St. George's, London, etc. At this time St. Bartholomew's was in a curious condition. There were many buildings, some of the wards opened directly on the thoroughfares and communication between the different parts was difficult. There were also private individuals living within the hospital grounds. These at times gave trouble, one having to be arrested for coming home late at night and assaulting the porter. In 1729 a complete alteration in the buildings and general plan was determined upon and this was carried out from 1730 until 1769. The present quadrangle was then laid out. It consists of four large blocks, each four stories high. The staircase leading to the great hall was decorated by Hogarth.

The number of beds in 1547 was probably 100. In 1644 from the record of the patients they are estimated as about 250 and in 1682 there were probably 300 beds divided among fifteen wards. To-day there are 741 beds. Out-patients were probably treated from early times, but their number was not large until comparatively recently. In 1682 the number is stated not to have exceeded 300 a year. Sir William Church states that the question of their treatment at that date was in dispute between the medical staff and the governors. He quotes a saying regarding the women out-patients of those days, who are said to be "by far the most numerous, troublesome and tedious in their examinations and making their complaints, there the Physician is or ought to be attended with a Beadle to keep good order and call aloud the names of the patients."

The time of the beginning of medical teaching is difficult to state. In the works of John Mirfield, who wrote a treatise on medicine about 1380, entitled "Breviarium Bartholomei," there is a reference to "magister meus," by whom he had evidently been taught. Dr. Moore states that the earliest student of whom there is a record was Brother John Helme, who lived in the reign of Edward III. According to the calendar students began to attend in 1660, but there was undoubtedly instruction given before this. Regulations regarding the students were issued in 1662. The library was re-established in 1667, it is stated, the earlier library having disappeared at the time of Henry VIII. The first record of a room set apart for a museum is in 1726, but a beginning had been made before this, for in 1714 there is an order that the stones removed by lithotomy should be hung up in the "Compting House"

according to ancient custom. In 1654 an order had been passed that the operation of lithotomy should be done in public. Edward Nourse was the first man to give regular courses of instruction. These were in anatomy and surgery. There is a syllabus of his lectures published in 1729. In 1750 the physicians and surgeons made application for leave to do autopsies and for this permission was granted, "the committee being of opinion that the practice might conduce greatly to the benefit of the public in general, also to the poor patients hereafter to be admitted." In 1767 the first theatre was opened and permission given to the staff to use it for operations and also for the purpose of giving lectures to the students. The school buildings were enlarged in 1791 when the fame of Abernethy had greatly increased the number of students in attendance.

Lock Hospitals.—These were adjunct establishments which had formerly been used as hospitals for lepers. When leprosy became rare in England they were put to other uses. Two became the property of St. Bartholomew's and were used principally for luetic patients. The one in Southwark, known as the *Lock,* was for male patients and the other at Kingsland, termed the *Spital,* was for females. Each contained about 30 beds and had regular attendants. In 1754 the attending surgeon, who was also known as the guide or guyder, had a house and a salary of 30 pounds a year. At this time Sir James Paget estimated that the locks cost about 700 pounds a year. The hospital funds not being able to support them, they were abolished in 1760 and wards were set apart in the hospital for the cases previously sent to the locks.

The Apothecary and the Hospital Pharmacopeia.—The history of these have been fully dealt with by Sir William Church [5] in an article not only of interest in relation to St. Bartholomew's but also in connection with the history of the use of drugs and the development of the hospital pharmacy. Since the restoration of the hospital in 1544 there is a good account preserved of the practice in regard to drugs and treatment. At that date the surgeons apparently supplied their own drugs and dressings (which certainly would hinder undue extravagance), but at times they were allowed extra remuneration for these or for special attention to certain cases. Some of these notes are curious, thus:

"Paid for helinge Henry Smythe's hedde which a sturdy beggar did brake, x^s."

And in 1550 this item appears:

"Paide for a great kettle for the surgeons to boyle with xxv^s x^d."

About 1570 the word "poticary" or "potticarye" appears in the records. Soon the question arose as to how much of the supplies he was to provide and in 1586 the decision was given that the apothecary was to supply the medicines administered "inwardely and not otherwise," while the surgeons were to supply "all other stuffe." In 1614 the apothecary was given rooms in the hospital. The expenses for drugs, etc., at that time amounted to about 105 pounds a year. In 1676 this had increased to nearly 400 pounds. Much of the early knowledge of the preparations used is obtained from the papers of Dr. Edward Browne, who was the eldest son of Sir Thomas Browne. These are dated 1670. In 1739 the first dispensatory of St. Bartholomew's was published and after it numerous other editions. There are many complaints as to the cost of drugs, not peculiar to this hospital nor to that time. Many attempts were made to cut down the expense. Thus in 1823 the treasurer wrote about the increased expenditure which was bad enough in regard to dressings but "in the article of leeches the evil is of still greater magnitude." The number used was 1000 a week, "and it does not appear that this increase is in any way to be attributed to a change in the practice of bleeding for *the cupper's bill* for the last quarter has also very considerably increased in amount." The fees for cupping in 1823 amounted to 46 pounds.

The hospital has prospered and is well endowed. Very recently additional ground has been obtained from the adjacent foundation of Christ's Hospital. Its modern history requires no mention.

Some writers have sneered at Rahere and called him insincere and a hypocrite. He may have been, but there seems no reason to suppose it from any written accounts, while his works speak otherwise. The evidence of 780 years is all on his side and against his detractors. We wish St. Bartholomew's Hospital continued progress and return in kind Dr. Moore's good wishes.

The Physicians and Surgeons.

It is, after all, in the lives and deeds of these that much of the history of a hospital is written, and St. Bartholomew's has reason to be proud of the record. Prior to the restoration there are few names to consider. There is one man of whom we should speak. This is John Mirfield, who was a canon of St. Bartholomew's Priory. He is thought to have passed from the hospital to the priory, as was not uncommon. He was a contemporary of Chaucer and the medical practice of his day was probably much like that of John of Gaddesden, who is thought to have been the original of Chaucer's physician. The writings of Mirfield are the earliest productions of the hospital. The work is termed "Breviarium Bartholomei," [6] and was written about 1380. Several manuscript copies exist, the handsomest of which Dr. Moore states is in the library of Pembroke College, Oxford. The book opens with a dedication, the essentials of which may be quoted from Dr. Moore's description: "Memory is slippery; this makes it wise to collect what is known of medicine into a summary. Another reason for the book is that there are so many false physicians about who commit frauds upon the public." He has some complaint to make about patients in general, "multi infirmi modernis temporibus valde impacientes sunt." Then, too, he says, "vero nisi statim in prima die senciant alleviare de medico diffidunt ejusque medicinas respuunt et contempnunt." All of which suggests that human nature was much then as now. The work is largely a compilation and he uses all the authors mentioned by Chaucer. Cases are referred to but no conclusions drawn from them and, as Dr. Moore notes, he

makes no mention of the Black Death which was prevalent in his time. Much of his treatment is ridiculous, but some things are as good to-day as then. He notes the use of sulphur water as a cure for scabies. Chronic rheumatism was treated by rubbing the part with olive oil, which was to be done while prayers were recited seven times, a means of making certain that some time would be spent in the treatment. He observed that an injury on the right side of the head might lead to paralysis on the left side, and relates an instance in one of their canons. The work is a curious mixture of medicine and medieval superstition. Mirfield repeated the opinions of older writers and drew few conclusions from facts observed by himself. One of the earliest records of the word "smalpockes" is in his writings.

For some time after Mirfield there seem no records of any note. An important factor in English medicine to be kept in mind in relation to St. Bartholomew's was the founding of the College of Physicians in 1518. This marked a new era in English medicine. Among the men of this day Dr., John Caius (1510-1573) must be mentioned. He was associated with the University of Cambridge—to a college of which his name is given—and with the College of Physicians. He occupied a house within the precincts of St. Bartholomew's but was not a physician of the hospital. The first banquet of the College of Physicians is said to have been held in his house in 1554. Caius wrote a treatise on the sweating sickness of some interest. He is to be remembered, too, as one who left a bequest to encourage the study of anatomy by which Harvey was probably aided in carrying on his work.

After the re-establishment of the hospital by Henry VIII, we have a complete record of the men associated with it. In following the conditions of practice and the relationships of the physicians and surgeons to each other, we probably see those which existed in England at these times. There was a great distinction made between the physicians and surgeons. The former regarded themselves and were generally regarded as being much superior to the latter. Surgeons were forbidden by law to prescribe physic and the College of Physicians frequently prosecuted and had punished those who infringed in this regard. Thus in St. Bartholomew's the surgeons had the actual charge of the patients in the wards, but they were controlled by the physicians, and even in 1754 we find the renewal of an order which prohibited the surgeons from prescribing any internal medicine except "mercurial physick or purges." The physicians at first were resident in the hospital grounds, but their duties were limited to prescribing for patients who were brought to them. This was done once a week in the large hall. It was no part of their duty to visit patients in the wards, but the surgeons were directed to bring their patients to the physicians. Perhaps the best idea of the relative positions of physician and surgeon can be got from the orders drawn up by Harvey in 1663 (note 7). This system was gradually changed; the physicians at first had only out-patients and the in-patients were brought to them once a week; later they were required to go round the wards once a week and see all the patients who were under the care of the surgeons. Some time after they began to admit patients themselves and in 1749 is an order that the physicians must visit the patients in the wards. It was some years after this that the surgeons were given complete charge of their patients.

There were special departments as well. Thus for some time there was a lithotomist who also frequently operated for hernia. This, as a separate position, continued until 1730, when it was merged with that of surgeon. The operation of lithotomy was held in great repute, for the lithotomists were paid a liberal salary and were given extra dressings, while there were extra charges for the diet and maintenance of their patients. The appointments as surgeons to the lock hospitals were also separate and were often given to the senior assistant surgeon to the hospital. They were abolished in 1760. A Bone-Setter was appointed in 1596. The first incumbent was John Isard, who was paid 8 pounds a year. He had one successor, after whose death the duties were performed by the surgeons. For some time there was also a curer of scald-heads. In 1621 Francis Holcombe was appointed. She was to receive twenty shillings for each cure. The disease must have been very prevalent and she very successful, for in 1635 she received 125 pounds, much more than the salary of any of the physicians. "Whether the disease or the remedy were exhausted does not appear," as Sir James Paget remarked, but the payments grew less and the last is mentioned in 1697.

The Physicians.—The charter of 1547 stated that there was to be one physician and one surgeon appointed to the hospital. But actually there were three surgeons in office and no note is found of any physician until 1567. It is quite possible that the duties of a physician were discharged by Thomas Vicary, who lived in the hospital and held a position apparently much like that of a medical superintendent. His position was like that of the master of the old days, but he was responsible to the board of governors and not to the priory. He was over all the officers of the hospital. Vicary was a prominent man and was sergeant-surgeon to Henry VIII, Edward VI, Mary and Elizabeth. He had been made in 1541 the first master of the amalgamated companies of Barbers and Surgeons. He is also the author of the first treatise on anatomy written in English. This is called "The Englishman's Treasure, with the true Anatomie of Man's Body," and was published in 1548 and reprinted by the surgeons of St. Bartholomew's Hospital in 1577. It was largely compiled and contains but little original matter. The first regular physician was Dr. Lopus or Lopez. The date of his appointment is uncertain, but it was between 1561 and 1567. It is fortunate that his successors have not followed in his steps, for Lopus came to no good end. His connection with the hospital had not been satisfactory, he had been reprimanded, and ceased to be a physician to the hospital in 1580. He was concerned in a conspiracy against the life of Queen Elizabeth and was hanged in 1594. For some time there was only one physician, and we find in 1633 the board saying, "there is noe need of two." In the latter part of the seventeenth century a second was appointed, in 1750 three, in 1854 four and at present five. The physicians lived in the hospital grounds

for some time. Later they were given a sum of money in place of a house.

Among the early physicians was Dr. Timothy Bright (not he of the kidney, who was at Guy's), remembered especially as the modern inventor of shorthand. This he brought out in a work entitled "Characterie," dedicated to Queen Elizabeth. He was appointed in 1586, but only held office until 1590, when, Sir James Paget states, he was dismissed for neglect of duty. Elsewhere he is said to have resigned. Be that as it may, he gave up medicine, took holy orders and was given a living in Yorkshire. He wrote several medical works as well as on metaphysics and natural science. One of his works was "A Treatise on Melancholy," in which he deals with "the Physicke-cure thereof and spirituall consolation for such as have thereto adjoyned afflicted consciences." Sir James Paget considers his theology to have been probably better than his physic.

Among the physicians one name stands out, that of Harvey. He was appointed physician to St. Bartholomew's in 1609 and probably held it until 1643. The records of his association with the hospital were published by Sir James Paget in 1846. Harvey probably had more influence in the hospital than any other physician. He drew up a set of regulations for the hospital which are given in the appendix.[7] These show the relationship between the physicians and surgeons better than any description. Harvey was evidently a strong champion of the rights of the physician and was not inclined to allow the surgeon any liberties. He apparently never lived in the hospital, although asked to do so, and there is a record of money paid to him in place of a house. His duties were to attend at least once a week in the hall of the hospital, where any patients requiring his aid were brought. He had to write his prescriptions and directions in a book. Such were all his duties at first. Probably some years later a regulation was added that in case the patient were too feeble to come to the hall, he should be visited in the ward by the physicians. In 1631 an assistant was appointed, as Harvey, having an appointment at court, would frequently be unable to attend at the hospital. In 1632 complaint was made by the surgeons that Harvey did not attend regularly on account of his court duties. The board then gave him permission to attend the hospital only when he thought fit. There is no record of his retirement as physician, but the last note of any payment made to him is in 1643, at which time he was in Oxford. After his return to London in 1646 he doubtless continued to take an interest in the hospital though not in any official capacity.

The next physician of note is Francis Bernard, who was appointed in 1678. He obtained the position in an unusual way and one worthy of note. The plague visited London in 1665 and St. Bartholomew's did not escape. The physicians deserted their posts and there is a record of a meeting of the governors held out in Essex, at which they censured the physicians for leaving the hospital. Bernard had been made apothecary in 1660 and through the plague he stuck to his post, doing also the duties of the physicians. It was but right that later he should receive the appointment himself. He had a magnificent library and was very learned. Before his death in 1698 he regretted that he had not made notes throughout his works which might have been of value. This is said to have influenced Charles Bernard, a surgeon and one of his contemporaries on the staff, who also had a celebrated library, to make many marginal comments through his books. There are varying statements as to the relationship of the two Bernards.

The next physician was Edward Browne, a son of Sir Thomas Browne, who was appointed in 1682. The first accurate record of the formulæ used in the hospital is found in a note-book of his dated 1670. There seems little doubt but that Browne used Peruvian bark for ague and there is an interesting letter, quoted by Sir William Church,[5] from Sir Thomas Browne to his son regarding its use. Among those who followed are David Pitcairn (1780), who first recognized the association between rheumatism and endocarditis; William Austin (1786), who was the first lecturer on chemistry and showed that the chalk stones of gout were not composed of chalk; and John Latham (1793), who wrote on diabetes. Of the men of more recent days it is not necessary to speak.

The Surgeons.—In 1547 there were three surgeons appointed who were paid 18 pounds a year. Later this was increased and they were given extra payment for special cases. While they had charge of all the patients in the wards, yet their practice was largely controlled by the physicians. Their field of work was also for a time limited by the separate positions of lithotomist and bone-setter. Of the early surgeons the one best known was William Clowes,[8] who was appointed in 1575. He had been attached to both the army and navy and had seen considerable service abroad. He was one of the earliest medical writers who wrote in English, then thought to be far from proper in medical works. In his introduction he says: "But if phisitions be angry that I have written physyke in englyshe let them remember that the grekes wrote in graeke, the Romayns in latyne, Avicenna and the others in Arabike which were their own proper and maternal tongues." His best works are "Prooved Practice for all young Chirougians" and a "Treatise on Struma." He had evidently read widely and quotes many authors. There are many of his quaint sayings and proverbs which are sometimes quoted. He had himself a number of secret salves and ointments—a not uncommon practice of those days. One of his books closed with these lines:

"All these things should be observed by surgeons as their vowes.
I wish we all could follow this. Finis. William Clowes."

The next surgeon of note was John Woodhall or Woodall,[9] who was appointed in 1616. He was surgeon to the East India Company and also had control of the surgical affairs of the Navy. His great work was "The Surgeon's Mate, or a Treatise discovering faithfully and plainely the due contents of the Surgion's Chest, the uses of the instruments, the vertues and operations of the medicines, etc." It was first published in 1617. He protested against the custom of his time which denied to the surgeons the right to prescribe for their patients

without the supervision of a physician. Thus he says in The Surgeon's Mate: "Who is hee that can cure a wound, a tumor, an ulcer, yea but an ague with his hand only without fitting medicines? Surely no man; then it must necessarily follow that Surgery, Diet and Medicines (I meane both outward and inward) are inseparable companions and therefore all to be used in the art of curing man's body; and that in the person of one man." These ideas were gradually to gain strength and prevail. There are several conditions to be kept in mind relative to the gradually changing relationships of physicians and surgeons. As Dr. Moore points out, the physicians were as a class much more learned than the surgeons, at any rate more versed in the knowledge of books. Consequently they were more influenced by traditional ideas and had only recently begun to observe and draw conclusions from their own impressions and experience. They had much tradition but little observation. The surgeons, on the contrary, had read little, were not learned in the knowledge of the schools but had observed more. They found it easier to accept new ideas and methods. About this time one of the first learned surgeons was appointed, Charles Bernard (1686). His namesake, the physician, has already been mentioned. Charles Bernard is said to have specially emphasized the recurrence of malignant growths. He was a very learned man, had a magnificent library and is mentioned as a friend of Swift. Edward Nourse (1745) was the first surgeon to give regular instruction in anatomy and surgery. A syllabus of his lectures was published in 1729. Among his pupils was Percival Pott (1714-1788), one of the best known names in surgery. He was appointed surgeon in 1749. In 1756 he was thrown from his horse and sustained a compound fracture of the leg. Amputation was advised by the surgeons who first saw him, but when his former teacher and colleague Nourse arrived, he thought an attempt should be made to save the foot, in which they succeeded. This fracture is said to have been the same to which his name is given. To improve the forced inactivity during his recovery he began to write his first book. He was a voluminous writer and had a great influence on the surgical thought of this time. His work on the spine was published in 1779 and 1782. The next great name is that of John Abernethy (1764-1831), who was elected assistant surgeon in 1787 and surgeon in 1815. He lectured first on anatomy and then on surgery. Of his fame it is not necessary to speak. He attracted students in large numbers and from his time the modern influence of the medical school dates. It must be confessed that at this day there may be difficulty in determining the reasons for his high position in English medicine. He had an unusual personality, he was evidently a wonderful teacher, and it is more to these that we must look for his influence than to his writings. There are many anecdotes related of him which have gone into medical history. He founded a hospital medical society in 1795 and was its first president. After his death the society was named after him and flourishes up to the present. William Lawrence (1824) is a well-known name. The condition of the school and methods of teaching at that time are well shown in the "Memoirs and Letters of Sir James Paget." He was one of the recent surgeons concerning whom it is not necessary to speak.

In conclusion is should not be necessary to urge all who are interested in the history of medicine to pay a visit to this medical shrine of St. Bartholomew. It is not the place to mention the position and influence of the hospital to-day. It is no wonder that wherever we meet a graduate of the school he refers with pride and affection to old "Barts." One can not visit the hospital without being stirred by its history. Dr. Moore says of the entrance: "Its Smithfield gateway, through which passed men of the generation whose fathers saw William the Conqueror enter London, has ever since been open to the sick poor." Looking at the hospital one may reflect on the misery its walls have contained, the sickness, the sorrow, the number who have "wrestled with the pangs of old mortality," and have ended their earthly pilgrimage, but we had rather be with him who looks on the other side of the shield. We should not leave St. Bartholomew's without a reference to the church of St. Bartholomew the Great. The building is difficult to find unless one knows the exact location, for little can be seen from Smithfield, as the church has been completely surrounded. The entrance is through an arch leading into an enclosure which recalls Stevenson's description of the churchyard of Grayfriars in Edinburgh. "Round a great part of the circuit houses of a low class present their walls to the churchyard. Only a few inches separate the living from the dead. A damp smell of the graveyard finds its way into houses when workmen sit at meat. Domestic life on a small scale goes visibly forward at the windows." The church has been elsewhere well described.[19] On the north side is the tomb of the founder with the inscription: "Hic jacet Raherus primus canonicus et primus prior hujus ecclesiæ." The effigy over the tomb is of wood and was probably placed there shortly after the burial. There are the figures of two monks kneeling, each holding a volume of the Scriptures open at the fifty-first chapter of Isaiah. It is a fit resting place for Rahere within the walls of the church built by his endeavor and near the hospital in the founding of which "he builded better than he knew."

Appendix.

(1) The principal articles consulted are given here and in the following notes. I desire to express specially my indebtedness to Dr. Norman Moore both for his writings and for much personal kindness and assistance.

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The Principles and Practice of Medicine: An Inaugural Lecture. London, 1893.

A Brief Relation of the Past and Present State of St. Bartholomew's Hospital. London, 1895.

The History of the Abernethian Society. London, 1895.

(2) This is given in full in the St. Bartholomew's Hospital Reports, Vol. XXI, 1885, with an introduction by Dr. Moore. The book is worth reading if for nothing more than the English. Of the original Dr. Moore says: "The canon wrote in Latin in a good twelfth century style. He had read but little of the poets, but had St. Jerome's version of the Bible at his finger ends. He uses its phrases on every occasion and seems as much at home in the Minor Prophets as in the Psalms."

(3) This is called the Charter of King Henry the First to St. Bartholomew's Priory, addressed to the Archbishop of Canterbury and to Gilbert the Universal, Bishop of London, in the year 1133. A copy edited from the copy in the Record Office by Dr. Moore was published in 1891. The Bishop of London in 1133 was the successor of Richard de Belmeis, who helped Rahere in the foundation. He was known as Gilbert the Universal on account of his wide knowledge. The charter granted certain rights to the foundation and contains many curious legal terms and phrases.

(4) These orders were reprinted in the St. Bartholomew's Hospital Reports, Vol. XX, 1884. They are also in the Surgeon General's Library in the same volume as Vicary's "The Anatomie of the Bodie of Man," both reprinted by the Early English Text Society. It contains plans of St. Bartholomew's in 1560 and 1604. They probably served as a model for orders which were issued for the four royal hospitals in London in 1557. These are called "The Order of the Hospitalls of K. Henry the VIIIth and K. Edward the VIth, viz.: St. Bartholomew's, Christ's, Bridewell, St. Thomas's." Dr. Osler has a copy of this work. About this period no doubt many of these sets of orders were published. Dr. Hurd has showed me a copy of one published in 1676 at De Clermont Ferrand in France, entitled "Reglement Général pour la Direction et Economie de L'Hopital Général de cette ville." This in its general character is much like the English ones. All of these copies of regulations give many of the duties to be done in much detail. Some are very amusing, perhaps none more so than some to be done by certain of the officials in St. Bartholomew's as directed by orders published in 1813. In these we may see that the porter had no sinecure. In addition to his careful watch at the gates and entrances he was to keep cattle and sheep about the hospital from disturbing the patients (no easy task when one remembers the close proximity of the Smithfield market), take care of the lamps, keep an account of the coal and bread served out, and lastly:

> "You shall superintend and take care of the pumps . . . and you shall assist the Beadles in frequently exercising the fire-engine."

The Beadles referred to were four in number. The *first* Beadle among many other duties received accident cases and measured out the wine for the patients. He was to carry out the dead bodies and notify the friends. In turn with the other Beadles he was to dig the graves and act as clerk at the funerals (at this time there was a burial ground within the hospital walls, which was used until comparatively recent times). He was not to leave the burial ground until the grave was filled up and he was to see the gate of entrance carefully locked. The *second* Beadle's special duties were to measure out beer for the patients and carry coal. The *third* Beadle with other duties was enjoined:

> "You shall take care of the fire engine and keep it always in proper order and frequently call the porter, the other beadles and the box carriers to your assistance in exercising the same, and superintend, wind up and regulate the clock."

The *fourth* Beadle's main distinction was to wait upon the coroner at all inquests.

There are excellent instructions given to the nurses. Distinction is made between the sisters, who have charge of the wards, and the nurses. There are also separate instructions for the day and night nurses. These are exceedingly practical and many of them would be suitable still.

(5) W. S. Church: Our Hospital Pharmacopœia. St. Barth. Hosp. Rep., 1884 and 1885, XX and XXII. These are most interesting papers and well repay reading. One point worthy of note is the account of the ward books of 1679. These were carried around with the physician and contain his prescriptions. Thus in Long Ward on November 17, 1679, we have a list of the patients and a note of the drugs ordered for them. The first on the list is named Shallow. One almost looks involuntarily to see if Slender or Silence is with him. The last on the list is James Valett, for whom six medicines were ordered. His case was evidently desperate, for before the next visit he was dead.

(6) There is special mention of this work in Dr. Moore's address on "The Progress of Medicine at St. Bartholomew's Hospital." The "Breviarium" is divided into fifteen parts and as in books of the time opens with a section on fevers. As noted he was one of the first to use the designation "smal pockes" for variola. He condemns drunkenness in strong terms. Some of his accounts of operations are curious. In one an accumulation of water in the brain was tapped by the cautery. He regrets that a distinction has arisen between the physician and surgeon, for "he cannot be a good physician who neglects every part of surgery."

(7) These are given in the "Records of Harvey," by Sir James Paget, published in 1846 and reprinted in the St.

Bartholomew's Hospital Reports, Vol. XXII, 1886. These were drawn up by Harvey in 1633 and submitted to the governors, by whom they were adopted. They are as follows:

1. That none be taken into the hospitall but such as be curable or but a c'taine number of such as are incurable. Allowed.
2, 3, 4 and 5. These are concerned with the admission of patients and were all allowed.
6. That none lurke here for releife only or for slight causes. Allowed.
7. That if any refuse to take their physick they may be discharged by the do^{r} or apothecary or punished by some order. Allowed.
8. That the chirurgions in all difficult cases, or where inward physick may be necessary, shall consult with the Do^{r}, at the tymes he sitteth once in the weeke and then the M^{r} himselfe relate to the Do^{r} what he conceaveth of the cure and what he hath done therein, And in a decent and orderly manner p'ceed by the do^{rs} direccons for the good of the poore and creditt of the howse. Agreed unto.
9. That no chirurgion or his man doe trepan the head, peirce the body, dismember or doe any greate oper'con on the body of any but wth th'app'bacon and by the direccon of the Do^{r} (when conveniently it may be hadd) and the chirurgions shall thinck it needfull to require. Agreed unto.
10. That no Chirurgion or his man practize by giveinge inward physick to the poor, w'hout th' app'bacon of the Do^{r}. Allowed.
11. That noe Chirurgion be suffered to p'forme the cures in this howse by his Boy or s'rvant w'hout his owne ov'sight or care. Allowed.
12. That ev'ry chirurgion shall shewe and declare unto the Do^{r} whensoev^{r} he shall in the p'sence of the patient require him what he findeth and what he useth to ev'ry externall malady; that soe the Do^{r} being informed may better w^{h} judgm^{t} order his p'scripts.
The Chirurgions p'test against this.
13. That ev'ry Chirurgion shall followe the direccons of the D^{r} in outward oper'cons for inward causes, for recov'ry of ev'ry patient under theire sev'all cures and to this end shall once in the week attend the Do^{r} at the sett howre he sitteth to give direccons for the poore. Agreed by ye Chirurgions.
14. That the Apothecary, Matron and Sisters doe attend the Do^{r} when he sitteth to give direccons and pr'scripts that they may fully conceave his direccons and what is to be done. Allowed.
15. This relates to patients who disobey orders and was allowed.
16. That the Apothecary keepe secrett and doe not disclose what the Do^{r} prescribeth nor the p'scripts he useth but to such as in the Do^{rs} absence may supply his place and that with the Doctors approbacon. Allowed.

Of the sixteen rules seven are specially for the patients and an equal number are to keep the surgeons in order.

(8) Clowes saw service with the Earl of Warwick in 1563 and in the Low Countries in 1585. He seems to have had good results in his treatment of gunshot wounds, but all were not as fortunate, for he says "many bad surgeons slew more than the enemy." Clowes was often concerned in disputes with quacks, in answering whom he did not spare abuse. He gives an account of his putting down a quack. His description of an amputation is very clear. Many interesting quotations from his works are given by Dr. Moore in an article on "The Physicians and Surgeons before Harvey," in the St. Bartholomew's Hospital Reports, Vol. XVIII, 1882.

(9) Woodhall was a distinguished naval surgeon. In addition to "The Surgeon's Mate" he published "A Treatise of Gangrene and Sphacelos," in which he states that during his twenty-four years as surgeon to the hospital he had done or assisted with over 100 amputations of arms or legs, and among these no death had occurred at the time of operation from hæmorrhage. Of these he says that all but four in each twenty recovered. The practice of burning the stumps, which he terms a "horrid cruell course," was not used by him. Woodhall gives these figures to support his view of only cutting off those parts of limbs which were already gangrenous.

(10) There are many descriptions of the church in works on the history and the antiquities of London. Dr. Moore published a description in 1888 and also contributed an illustrated article descriptive of the church in *The Century Magazine*.

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CRYOSCOPY AS AN INDEX OF RENAL INSUFFICIENCY IN SURGICAL DISEASES OF THE KIDNEY.

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The systematic study of the freezing points of various solutions was first undertaken by Raoult,[1] who applied to this method of investigation the term cryoscopy, from the Greek, meaning cold or frost, and defined his method as "The study of soluble bodies, based on the observation of the point of congelation of their solutions." It is a well-known fact that solutions of various salts freeze less readily than water. Every one knows that a much lower temperature is required to freeze sea water than fresh water and that a heavy brine is practically unfreezable. But the laws governing the freezing of solutions and their definite statement had not been proposed until Raoult made his studies of the subject. Some years previous to Raoult's studies, De Coppet[2] showed that when a molecule or a proportional quantity by weight of any substance is dissolved in a constant quantity of water the freezing point is always lowered a definite amount. Raoult gave four laws, in substance as follows: (1) All solid, liquid or gaseous substances when dissolved in a liquid lower the freezing point of that liquid. (2) The lowering of the freezing point is proportional to the amount of substance in solution. (3) When a molecule or a proportional quantity of substance is dissolved in a constant quantity of water the freezing point is always lowered a definite degree: this in substance had been stated previously by De Coppet. (4) When various different substances are contained in the same solution the freezing point of the solution is lowered an amount equal to the sums of the freezing points of each substance contained in the solution. While in a general way these facts had long been recognized, their significance had never been pointed out up to the time that they were stated. Since that time physical chemists have recognized in cryoscopy a means of determining definitely the character of a solution by its freezing point and a table of freezing points of various solutions has been made by which it is possible to identify them. Van't Hoff,[3] studying the freezing points still further, showed that equal volumes of isotonic solutions contained the same number of molecules or fragments of molecules and have the same freezing point. Biologists have long known that the rapidity with which solutions pass through an animal membrane depends upon the relative number of molecules contained in the solutions on each side of such a membrane; that is, upon the osmotic pressure and as the freezing point also depends upon the number of molecules contained in solution it offers an accurate means of testing the osmotic pressure of solutions.

[1] Comptes rendus de l'Académie des sciences, November 27, 1882.
[2] Annales de chim. phys., 1871 and 1872, Tomes xxiii, xxv and xxvi.
[3] Memoires de l'Académie royale des sciences de Suède, Stockholm, 1886.

The laws governing the freezing point of liquids are not without their exceptions. The freezing point has been shown not to follow exactly the number of molecules in substances contained in solution and this has been explained on the basis of the hypothesis of D'Arrhenius, who supposes that various salts in solution are dissociated more or less into radicals to which the term ions has been applied and the freezing point depends not directly upon the number of molecules contained, but the number of ions into which these molecules are dissociated when in solution. Neither is the freezing point of solutions always proportional to the amount of a substance in solution, for very frequently this is influenced by dilution. In general the greater the dilution the greater the number of molecules dissociated. In complex solutions the freezing point is not always the sum of the freezing points of the contained substances as stated in Raoult's fourth law, for sometimes molecules of various substances contained combine with one another, forming more complex molecules of less number which do not lower the freezing point proportionately.

The credit for the application of cryoscopy to general medicine belongs to Koranyi, professor at Budapest,[4] who with his pupils carried out a large number of physiological and clinical investigations on the osmotic pressure of various animal fluids. He applied the method particularly to diseases of the kidney and since this time the method has been tested by a large number of clinicians and investigators, most of whom testify to its value. Lindemann[5] first pointed out the possibility of its use in the differential diagnosis between suppurative and inflammatory processes affecting the lower genito-urinary tract and those infecting the kidney. Cystitis and pyelitis, for example, while giving rise to changes in the microscopic characteristics of the urine, have no influence on the freezing point. Moritz's[6] investigations are specially valuable from the fact that he was able to study the condition of the kidneys post-mortem in the twelve cases in which he had tested the freezing point and other characteristics of the urine for a considerable length of time during life. Senator,[7] Claude et Balthazar,[8] and Albarran[9] also deserve mention among those who first carefully studied this method of investigation and established its value. Casper and Richter[10] give the results of careful examinations in 90 cases of kidney disease. In

[4] Ztschr. f. klin. Med., 1897 and 1898, vols. xxxiii and xxxiv.
[5] Arch. f. klin. Med., 1900, vol. lxv, p. 1.
[6] Petersburger med. Wochenschrift, 1900, vol. xxv, N. F. 17, p. 225.
[7] Deutsch. med. Wchnschr., 1900, vol. xxvi, p. 48.
[8] Presse Médicale, 1900, vol. xviii, p. 85.
[9] Annales des maladies genito-urinaires, 1899.
[10] Functionelle Nierendiagnostik mit besonderer Berücksichtigung der Nierenchirurgie, Berlin und Wien, 1901.

most of these, cryoscopic examination was combined with other methods of determining renal insufficiency. They place a higher value on cryoscopic tests of the urine and blood in these cases than the phloridzin test, quantitative estimation of urea or other usual methods, but lay special stress on the agreement of all these methods when tried in a given case. The methylene blue test, which has been so highly commended by some recent investigators, they did not find of special value. Kümmel [11] has had the greatest experience with cryoscopy of any observer and has been one of the most enthusiastic advocates of its use in renal surgery. At the Thirty-First German Surgical Congress he gave the results of 265 freezing point determinations of the blood, including 170 cases in which various operations were performed on the kidneys. In all of his operative cases and in several cases in which post-mortem examinations were performed, the correctness of the estimate made of the condition of the kidneys from cryoscopic examination was determined. Kümmel's series of cases includes almost every pathological condition in which surgical intervention could be considered indicated, including numerous cases of hydronephrosis, pyonephrosis, tuberculosis of the kidney, renal calculus, and tumors; there were also a small number of cases of chronic nephritis in which decortication of the kidney was done. Like Casper and Richter and several other observers, Kümmel has compared the results of cryoscopic examinations with those of other modern tests of renal insufficiency. He does not consider the methylene blue test of sufficient value to be used as a routine, but employs the phloridzin test, quantitative determination of the urea and the other usual tests in all doubtful cases, in conjunction with cryoscopic examination. The latter he considers the most important of all as an index of renal insufficiency.

Kümmel's assistant, Dr. Rumpel, who has done a large amount of the routine work for him, has also tested the freezing point of the blood and urine in a series of cases of typhoid fever and other diseases and finds no important variation from normal point of healthy patients.

Cryoscopy does not seem to have come into very general use in this country or England, for very few papers have appeared in the English language. Ogston [12] briefly reports a small series of cases in which he used the freezing-point determinations with very satisfactory results and suggests its use in diseases of the liver. Sollmann [13] reviews the literature and adds some personal experience with regard to examination of the urine.

The freezing point of both the urine and the blood has been employed as an index to the condition of the kidneys. Under normal conditions the freezing point of the urine varies between —0.9° and —2.0°. A freezing point above —0.9° is generally taken as an indication of renal insufficiency. Physiological variations in the freezing point of normal human blood are far less than those of the urine. Normal blood has a freezing point of —0.56° C. below that of distilled water with a physiological variation of from —0.55° to —0.57°, or only 2-100 degrees. An increase of the freezing point to over—0.58° shows that renal insufficiency is present. While it is more difficult to obtain blood for freezing than urine, the very slight variation in its osmotic pressure makes this test considerably more valuable than that of the freezing point of the urine alone. An advantage of this test over the ordinary chemical tests is that the freezing point is influenced by all the products excreted in the urine and there can be little doubt that many of these waste products are of as great importance in determining the functional activity of the kidney as urea and chlorides for example, which are perhaps most commonly estimated quantitatively. Even under normal conditions the amount of urea excreted daily varies greatly, ranging from 20 to 35 grammes, a variation much greater, no doubt, than that of the total excreta of the urine. The specific gravity of the blood and the urine is of much significance, but the normal variations are also quite great, the blood being influenced by age, sex, condition of nutrition, etc., the specific gravity ranging between 1046 and 1067; while the osmotic pressure of the blood is very constant and corresponds under nearly all conditions to a freezing point of —0.56° C. Not only does this new method seem to offer the advantage of greater accuracy, but is far simpler than the very elaborate methods of quantitative determination or determination of specific gravity which must be used when specially accurate results are desired. The freezing point is determined by means of Beckmann's thermometer or more simply by a modification of Beckmann's original apparatus suggested by Heidenhain. Some believe that the Heidenhain apparatus is not as accurate as the original Beckmann apparatus, but it is in quite general use and experience with the results in a considerable number of cases seem to show that the variation is not more than 1-1000 of a degree, which may be left out of account for ordinary purposes.

To determine more definitely the value of this method the blood of 25 patients in the wards of the Johns Hopkins Hospital who were in normal condition so far as their kidneys were concerned was taken and the results of the freezing point determinations and usual routine tests of the urine were compared. The modified Heidenhain apparatus was used in these tests. It consists of a 45 cm. long thermometer with a large bulb which is graduated from one degree centigrade above freezing to four degrees below the freezing point. The degrees are subdivided into tenths and hundredths and the scale is sufficiently large so that 1-200 of a degree can be easily read. To allow for expansion of the mercury in warm weather and at ordinary room temperature a reservoir bulb is provided at the upper end of the tube. For ordinary examinations about 20 cc. of blood or urine are taken, although the test can be made with a fair degree of accuracy with half that amount. The blood or urine to be examined is placed in a test tube, which in turn is inserted in a larger tube which makes an air space about the fluid to be frozen, insuring gradual cooling of the liquid to be examined. To lower the tem-

[11] Centralblatt für Chirurgie, 1902, xxix, p. 121 of Beilage.
[12] Lancet, 1901, ii, 1253.
[13] American Medicine, 1902, N, 656.

perature to the freezing point a mixture of salt and ice may be used, but an apparatus is also on the market in which the lowering of temperature is brought about by evaporation of ether. The test tube containing the blood or urine to be examined may be placed directly in the salt and ice mixture until the mercury comes down out of the reservoir bulb. This will save a great deal of time in the freezing and if the blood or urine be warm it may be difficult to freeze it without this is done. The test tube containing the solution is then placed within the second tube which acts as an air chamber. While the solution is cooling it is stirred constantly by means of a wire loop so that the solution is thoroughly mixed and kept everywhere at the same temperature. The mercury sinks more or less rapidly, not to the point of freezing, but considerably below it before freezing really takes place. As freezing occurs heat is given off and the mercury again rises to the freezing point, where it remains for some time. If left in the freezing mixture, however, the mercury again begins to fall and can be reduced if desired to the temperature of the ice and salt mixture. Before the thermometer is used it should be tested by trying the freezing point of distilled water. Usually there will be a slight variation from the zero point which must be taken into account in estimating the freezing point of the blood or urine to be tested. When the solutions and mixture are prepared, not more than ten or fifteen minutes are required for freezing and the time may be reduced one-half if a second test is to be made after everything is prepared. The necessary amount of blood for a test can be readily obtained by the use of a large aspirating syringe in the same way as blood is usually taken for blood cultures. The arm should first be cleaned up under strict aseptic precautions and the syringe and needle boiled. A band is tied about the arm, which makes the large veins prominent, and a needle can usually be readily inserted into one of the veins near the bend of the elbow. In certain cases there is so much subcutaneous fat that it is difficult to find a vein and in others the veins may be extremely small. For these reasons it was found necessary to expose the vein by dissection under cocaine anæsthesia or to do a venesection in about one-third of the cases. Patients usually appreciate a careful study of their cases and seldom object to this. It is not necessary to defibrinate the blood, as it has been shown that the freezing point of the entire blood is the same as that of the blood serum and the osmotic pressure is dependent only upon the number of molecules of dissolved substances, not upon suspended particles.

In preparing the freezing mixture the ice should be rather coarsely broken; otherwise it is not readily stirred and melts too rapidly to be used for testing a number of specimens. The ice is put into the jar in layers, the first layer is particularly coarse, and a generous quantity of coarse salt is sprinkled in with each layer. The tube which acts as an air chamber should be held in position while the ice is packed in place, otherwise it will be very difficult to get it in place in the jar. When the jar is packed full the freezing mixture is stirred by means of a heavy wire ring and rod, which mixes the salt and ice thoroughly. The mixture thaws rapidly and if several specimens are to be frozen the water may be poured off and fresh ice and salt added from time to time. When the jar is once filled, relatively much less time is required to freeze a number of specimens.

The series of cases tested in this hospital, using the blood of patients in normal condition so far as their kidneys were concerned, gave surprisingly uniform results. The blood in 23 out of 25 cases froze at exactly 0.56° C. The samples of blood examined were taken from patients of nearly every possible combination of age, sex, color, occupation and condition of health. In the two remaining cases there was a variation of but 1-100 degree centigrade, which is within what has been found to be normal limits. There was nothing to account for this slight variation. The patients suffered no ill effects from the taking of blood, even when venesection or dissection of a vein was found necessary. In most of the cases the arm of the patient and the freezing mixture were prepared by the nurse, but when one does unaided everything necessary for cryoscopic examination of the blood, the amount of time consumed need not exceed three-quarters of an hour. Where several specimens of blood are examind a great deal of time is saved. The test is then one which is not more time-consuming or difficult than very many of the modern methods of clinical examination which are in general use. Three cases of pus kidney which came to necropsy later were examined and in each the variation of the freezing point from the normal was quite striking. The results obtained in the series of cryoscopic examinations of the blood and urine agree with those of others who have carried out such investigations and do not seem to have sufficient interest to make them worthy of detailed report, but post-mortem examination has been possible in so few cases in which cryoscopic examinations have been made that a brief report of these three cases may be of interest.

Case I.—A well-developed but poorly nourished white man of 58 entered the hospital with his bladder distended with urine to the level of the umbilicus and with œdema of the feet and ankles. For three months he had been troubled with dribbling of urine and for a month with abdominal pain. Nearly a gallon of urine was withdrawn with a catheter, and a permanent catheter was left in the bladder. The patient passed reasonably large amounts of urine, but the percentage of urea was low in spite of free use of diuretics. Total amounts of urine voided for 4 days before death: 1540 cc., 3180 cc., 3820 cc., 2840 cc. The patient's general condition became gradually worse and he sank into an unconscious state 48 hours before death, his symptoms being those typical of uræmia.

Urine cloudy, pale yellow, S. G. 1010, alkaline, no sugar, trace of albumin, sediment cloudy and containing pus cells, triple phosphates, a few red blood cells, shreds of mucus. Practically the same condition found on five analyses.

Freezing point of blood.....	—0.71°
Freezing point of urine.....	—0.53°

Urea .....4.5 mg. to cc.
Specific gravity 1.012

Anatomical diagnosis: Hypertrophied prostate, pyonephrosis and multiple abscesses of both kidneys.

Case II.—A colored man of 59 was brought into the hospital in a semi-comatose condition. No history could be obtained as to his illness. On examination the bladder was found distended; attempts to catheterize failed, but the bladder was immediately aspirated and 2500 cc. of urine withdrawn. A later attempt at catheterization proved successful, a drainage catheter was left in the bladder, through which the bladder was irrigated daily, fluids were given freely by mouth, rectum, and infusion, and for a week the patient's condition improved. Then without any apparent reason his condition became worse and he rapidly sank and died the ninth day after admission.

For five days the amounts of urine varied from 900 to 2180 cc.

Urine bloody, S. G. 1014, acid, no sugar, albumin in large amount. Sediment reddish white, containing blood and pus, a few hyaline and granular casts, no crystals.

Freezing point of blood..... —0.69°
Freezing point of urine..... —0.47°
Urea .....14 to 16 grams
Specific gravity 1.009

Anatomical diagnosis: Œdema of lungs. Multiple abscesses of kidneys. Hypertrophied prostate. Cystitis.

Case III.—A white man of 74 was admitted to the hospital with a history of frequent micturition for 6 months. He was able to void urine, but 450 cc. of turbid residual urine was withdrawn on catheterization. His general condition was very bad and urination and catheterization very painful. He became somnolent and at times delirious on the twelfth day after admission and gradually sank and died on his thirteenth day in the hospital.

Daily amounts of urine varied from 1440 to 1960 cc.

Urine turbid, pale yellow, S. G. 1014, acid, no sugar, albumin present in large amount, sediment contained white and red blood cells, epithelial cells, triple phosphates and large amounts of mucus; no casts seen.

Freezing point of blood..... —0.63°
Freezing point of urine..... —0.87°
Urea .....4.5 mg. to cc.
Specific gravity 1.010

Anatomical diagnosis: Pyonephrosis.

The results of cryoscopic examination of the blood in this comparatively small series seemed to show that it is an extremely reliable and satisfactory test. The results agree entirely with those of Kümmel, Koranyi and his pupils and others who have examined larger numbers of cases. The freezing point of normal human blood is practically constant at 0.56° C. with an occasional slight variation of 1-100 degree in healthy persons; while in diseases of the kidney extensive enough to endanger the life of a patient it has invariably shown a considerable variation from these normal limits, as was true of the cases here reported and has been found in the experience of others who have had the opportunity to observe larger series of cases.

The variation of the freezing point of the urine is much greater and has a correspondingly smaller value. In the cases tested, the mixed specimens of urine varied within the limits which have been determined to be normal, that is, between —0.9 and —2.0. If separate urines can be obtained by catheterization of the ureters the results of cryoscopic examination are much more valuable in diseases of the kidney. Through the kindness of Dr. Guy L. Hunner, Resident Gynæcologist at the Johns Hopkins Hospital, I was able to examine specimens obtained by catheterization of the ureter in seven cases in which disease of the kidney was suspected. In three of these cases the exact condition of the kidney was subsequently determined by operation. In none of the cases was there renal insufficiency, the sound kidney being in good enough condition to do the necessary work for the body, but in two cases of tuberculosis of the kidney the difference in the freezing point of the urine taken from the diseased kidney and that of the mixed specimen or a specimen taken from the normal kidney was quite striking and indicated even more definitely than the results of quantitative examination of the urea, tests of specific gravity and the other usual tests of the urine, the location of the disease. These cases in which disease was found may be of sufficient interest to deserve brief report.

A woman of 57 had been suffering from bladder trouble for several years. After the usual diagnostic methods had been employed, tuberculosis of the bladder, ureter and left kidney were diagnosed. Three operations were performed, vesico-vaginal fistula with continuous irrigation for the improvement of the condition of the bladder, later nephrectomy and partial removal of the ureter and a third operation for closure of the vesico-vaginal fistula. The patient made good recoveries from her operations.

Pathological examination showed tuberculosis of the kidney, pelvis of the kidney and ureter. Urine was pale, slightly turbid, specific gravity 1012, faintly acid, no sugar; trace of albumin, whitish sediment containing much pus, a few epithelial cells but no casts.

Freezing point of the blood..... —0.56°
Freezing point of the urine, mixed specimen.. —1.89°
Freezing point of the urine, left kidney.... —0.49°

A white woman of 39 was operated upon, nephrotomy being performed for abscess of the left kidney. Two small calculi were found. Two years after first operation nephrectomy was done for persistent sinus, a very much atrophied kidney being removed. There was also cystitis for which vesico-vaginal fistula was done with secondary operation for closure. Satisfactory recovery followed. A large number

of examinations of the urine were made. The results are fairly well shown by the following:

Urine: Light amber, cloudy, specific gravity 1008, alkaline, no sugar, trace of albumin; slight white granular precipitate. Microscopical examination showed epithelial and pus cells, triple phosphates and numerous bacteria.

Freezing point of the blood..... —0.56°
Freezing point of the urine..... —1.23°

A white woman of 29 was admitted to the hospital with symptoms referred to the right kidney. A diagnosis of tuberculosis of the kidney, ureter and tuberculous ulceration of the bladder was made after cystoscopy and catheterization of the ureters. Right nephro-ureterectomy with excision of the ulcer from the bladder was performed. The kidney was found badly diseased with a number of tuberculous cavities; there was also tuberculosis of the pelvis of the kidney and ureter. Tuberculosis of the lungs was suspected. The patient made a good recovery from the operation. Specimens from catheterization of the ureter were obtained on several occasions. The mixed specimen of urine was dark amber in color, specific gravity 1010, acid, no sugar, slight trace of albumin, whitish sediment containing numerous white blood corpuscles. The urine obtained from the left kidney contained no blood cells. Repeated examinations of the sediment from the right kidney failed to show tubercle bacilli, but the patient reacted to tuberculin.

Freezing point of the blood..... —0.56°
Freezing point of the urine, right kidney. —0.625°
Freezing point of the urine left kidney.. —1.74°

While the freezing point of the blood indicated that the sound kidneys were in condition to do the necessary work for the body, the difference in the freezing points of the urine from catheterization of the ureters, clearly showed the location and extent of the disease in the tuberculosis cases, and more strikingly than the usual tests.

Unfortunately I did not obtain specimens of urine from catheterization of the ureters in the case of calculous pyonephrosis, so only the negative information that renal insufficiency was not present could be determined.

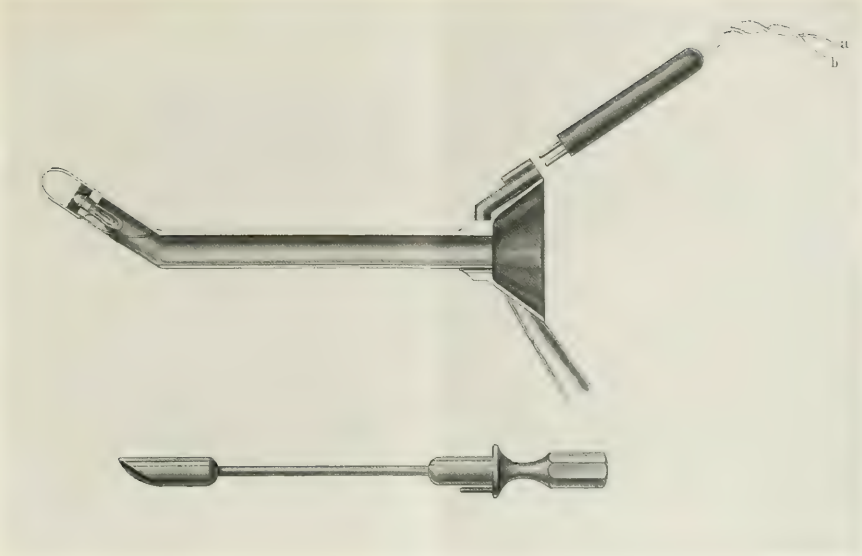
A sufficiently large number of cryoscopic examinations have been made by reliable observers to prove positively the value of the test. The advantages over the usual quantitative chemical tests have already been mentioned, the chief advantage being that it gives an index of the total waste products excreted by the urine instead of that of a single constituent. While it is desirable that information be obtained from as many sources as possible as to the condition of the kidney before extensive operations, the cryoscopic test has proved so reliable in the hands of numerous observers and is so much simpler than many of the methods which have been employed that it would seem that it alone might be relied upon to determine the condition of the kidney provided it is possible to obtain specimens by catheterizing both ureters. The value of cryoscopic examination of mixed specimens alone is far less and does not compare in accuracy with the value of the cryoscopic examination of the blood. In all doubtful cases both tests may be used in combination with the usual chemical tests with added certainty as to the state of the kidneys. The chief value of the test is in determining the prognosis in doubtful cases. If the examination indicates a condition of renal insufficiency of high degree, operation may be contraindicated. In other cases it may be of aid in determining whether nephrectomy or a less extensive operation, for example, nephrotomy or nephrolithotomy, should be given preference. The field of usefulness of this test in surgical cases is a limited one, but in cases in which such a test is needed it is often very much needed and the information obtained is correspondingly valuable. In favor of cryoscopic examination it may be said that it is simple and may be readily made by those little experienced in its use; that it does not require special training as is required for accurate use of many other methods of examination; that it is not more time-consuming than very many other methods of clinical examination in general use; that the results of this method of examination have been determined by a large number of observers to be more reliable and accurate than those of the tests now in general use; that while this method of examination has a limited field of usefulness, it is of decided value in cases in which its use is indicated.

A SIMPLE ELECTRIC FEMALE CYSTOSCOPE.

By Thomas S. Cullen, M. B. *Associate in Gynecology, the Johns Hopkins Hospital.*

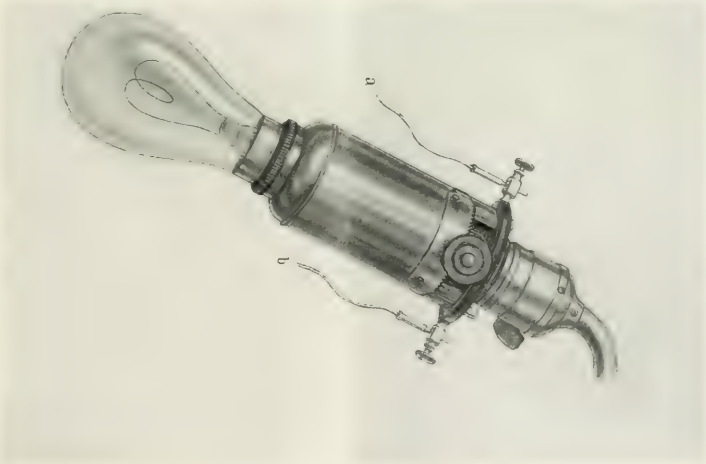
For the usual exploration of the bladder any cystoscope will answer, but where careful scrutiny of the ureters is required, considerable difficulty is often experienced by those who are not called upon to do vesical work every day.

Electrical cystoscopes if properly constructed render the examination of all parts of the bladder comparatively easy. There are, however, several serious objections to their usage. In the first place the electric lamps are so small that if the utmost care be not exercised they are burned out, occasioning not only much delay, but also considerable expense. Again, the small connecting wires on several of the cystoscopes have only lasted for a few weeks, and with their destruction the usefulness of the cystoscope was entirely gone. Probably the chief drawback to the use of the electrical cystoscope has been the unreliability of the storage battery which would so frequently give out just when it was most needed.



Longitudinal Section of the Cystoscope.

Fig. 1.—With the obturator in place the sharp angle near the tip of the instrument is completely removed. The lamp is large and is easily withdrawn from the tip of the instrument. There are no wires to get out of order. The electrical attachment is indicated and may be made by an interlocking device if so desired. The wires *a* and *b*, if so desired, can be covered by rubber tubing, allowing of their sterilization. At Fig. 2 in *a* and *b* the other ends of the electric wires which are usually six to eight feet long are shown.



The New Transformer in Position.[2]

Fig. 2.—It is inserted between the plug and the ordinary electric lamp bulb. The current is turned on as usual. With the small wheel at "off" the cystoscope receives no light. When at "on" there is abundant light for the strongest cystoscope. With the wheel in its present position there is sufficient light for the cystoscope.

[2] This transformer was recently designed by a Rochester electrician and will in the large cities practically do away with the use of storage batteries for lighting electrical instruments.

With the idea of overcoming all these obstacles the accompanying instrument was planned. In shape it resembles a short male cystoscope. Its connections are all covered, at no point being exposed. The electric lamp is relatively large in size, thus giving good illumination and diminishing the possibility of burning out. The instrument is readily controlled with a long handle. The lumen of the tube is perfectly straight. The controller represented in Fig. 2 has recently been made by one of the Rochester firms and is an admirable addition to our cystoscopic armamentarium. It does away entirely with the necessity of the battery and can be used wherever the electric current has been installed. This instrument is so small that it can be readily carried in one's pocket. It is to be inserted between the socket and the globe of any electrical fixture. To it the cystoscopic wires are then attached and we can by the small wheel regulate absolutely the amount of current desired. I have been using the same cystoscopic lamps for several months without the slightest difficulty. If, by any chance, the lamp should give out, the cystoscope need not be withdrawn but can be utilized as a Kelly cystoscope, the head mirror and reflected light being used.

Our instrument is handled as follows: Both obturator and cystoscope are placed in pure carbolic acid for ten minutes, then rinsed in alcohol, then in sterile water.[1]

A small transformer is now inserted between the ordinary electric globe and its socket. The cystoscopic wires are attached to the transformer, care being taken to note that the small wheel indicates current "off." The cystoscope is now connected up and the wheel gradually turned until the necessary light is obtained. It is unnecessary to darken the room. After cleansing the urethral area with bichloride the ureter and bladder are rendered insensible by weak solutions of cocaine.

[1] This method of preparation has been employed by Young and others with perfect satisfaction. After use the instrument is thoroughly scrubbed with soap and water, a fine brush being used.

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ON OBLITERATION OF THE SUPERIOR VENA CAVA.

By William Osler, M. D.,

Professor of Medicine, Johns Hopkins University.

While signs of compression of the superior vena cava are not very uncommon in cases of aneurism of the aorta and in mediastinal tumors, instances of complete obliteration of the vessel, with the establishment of collateral circulation, are extremely rare. I here report one case which was under our observation for nearly three years, long enough to make the diagnosis of fibroid obliteration by exclusion, and a second in which the obliteration was due to compression in Hodgkin's disease. A third case due to aneurism I have already reported.[1]

Dr. Hume has collected for me from the literature the histories of 29 cases of complete obliteration of this vessel. Many of the reports are imperfect, and only the anatomical record is given. Of the cases 13 were males, 12 females and in 4 the sex was not specified. Eighteen of the patients were between the ages of 30 and 60. So far as the cause could be ascertained the cases could be grouped as follows: I. Thrombosis due to disease within the vein, 10 cases. Of these, 8 seem to have been due to a simple phlebitis; one, the case of Duchek, was a propagated thrombus from the periphery, and one a remarkable case of tuberculosis endophlebitis (Banti). By far the largest number of cases were due to: II. Disease outside the vein, 19 cases, grouped as follows: (a) tuberculosis, 4 cases; (b) mediastinitis, 4 cases; (c) aneurism, 4 cases; (d) syphilis, 3 cases; (e) periaortitis, 2 cases; (f) carcinoma, 1 case; (g) fibroma, 1 case.

The symptoms of the condition depend entirely upon the degree to which compensatory circulation has been established. Obliteration of any one of the three great veins of the body may exist for many years with even good health and a completely effected collateral circulation. There seem to be two groups of cases, one in which the patient has had for years complete compensation and good health and the symptoms set in acutely. This was well illustrated in a case at the Montreal General Hospital, reported by Wilkins (Case 6), in which I made the dissection. The patient was a robust, hale man, aged 34, who twelve months before, while lifting, felt something give way. He had occasional attacks of dyspnœa and a smothering feeling. His urgent dyspnœa came on somewhat suddenly, and for three months he had a great deal of

[1] Journal of the American Medical Association, June 7, 1902.

oppression of breathing, due in large part to recurring effusion into both pleural sacs. There was complete fibroid obliteration of the superior vena cava.

In the second group the symptoms of obstruction of the venous circulation are constantly present, though varying in intensity, as in the case here reported, and the condition may be consistent with a fair measure of health.

Case I.—*Clinical Summary: Hard work, alcohol and exposure; dyspnœa, swelling of the neck and face; gradual distension of the superficial thoracic and epigastric veins; improvement for a time; gradual increase in the size of the superficial veins; on third admission tubercle bacilli were found; final admission with fever and delirium and unconsciousness; lumbar puncture, tubercle bacilli in exudate; tuberculous caries of spine; fibrous mediastinitis with obliteration of the superior vena cava and innominate veins; tuberculous meningitis.*

Charles Diggs, colored, butcher.

First admission was on Dec. 7, 1898. The patient was at this time 22 years old. He complained of tightness across the chest, dyspnœa and swelling of the neck.

The family history was unimportant.

Personal History.—Patient had had no rheumatism, typhoid fever, malaria or pneumonia. He had not been subject to headache, nor had he any sensory disturbance. Venereal history; gonorrhœa six times. Patient says he has had a chancre, but from the description the sore was probably chancroid, and there have been no secondary symptoms. Tobacco: patient began smoking at eight years of age, and smokes several packages of cigarettes a day. Alcohol: gin, whiskey and beer have been used abundantly, fifteen glasses of beer at least a day. He has often been drunk. He is a heavy eater. He is often exposed to the weather, and has a great deal of heavy work.

The present illness began six days before admission. The patient went to bed feeling well, and woke up with dyspnœa. He noticed that his neck was swollen, and felt as if something were pressing against his chest tightly. The pain in his chest was not definitely localized. He noticed that his face was flushed. The patient had not been drinking on the night of the first symptoms, but had been drunk the previous night. The condition had grown worse each day. He had been treated before admission with doses of nitroglycerin, 1-100 of a grain, and had been given irrigations for his urethritis. The appetite was good and his bowels were regular. He thinks he has lost ten pounds since the onset of the symptoms.

Present condition.—The patient is a strong, well-nourished mulatto. The face and eyelids are puffy. The tongue is coated with a yellowish fur. No anæmia of the mucous membranes. The neck is full; the vessels are dilated and distended with blood. Slight general pulsation of the neck. No tracheal tugging. The chest is well formed; respiratory movements equal. There is distinct tenderness on pressure in the epi-sternal notch. The right clavicle is more prominent than the left.

The lungs are clear throughout on auscultation and percussion. There is no dulness below the sternum suggestive of mediastinal growth. Superficial veins on the thorax and of the upper right arm and shoulder are dilated.

Heart not enlarged; sounds quite clear. Pulse 78 to the minute, of fair volume and tension. The right radial is slightly fuller than the left; the vessels are palpable.

Glands: The inguinal, the left epitrochlear, the posterior cervical and the submaxillary are enlarged. There is no œdema of the legs. The reflexes are apparently normal. The differential count shows a practically normal ratio of leucocytes. The X-ray picture was negative and nothing abnormal could be seen with the fluoroscope.

Two weeks after admission a slight pleuro-pericardial friction rub was noted. On December 21 the patient was discharged, distinctly improved. The veins of the neck were less distended than on admission. During the first three days he had had a slight temperature, but since that time had been practically free from fever.

The patient was admitted a second time on December 1, 1899, complaining of pain in the chest and of swelling of the face. Since leaving the hospital he had been unable to do any hard work. Every exertion would cause swelling of the face and neck. He had been "drinking and sporting" until two months before the present admission, and during these two months there had been a steady pain in his chest, sometimes extending into the arms. He had slept poorly. On examination the superficial veins were found dilated in the forearms as well, and the thoracic subcutaneous veins were found to anastomose with the superficial and deep epigastrics. The current in these thoracic veins was distinctly from above downwards. The radial pulses were equal. No thrill and no diastolic shock were observed during his stay in the hospital. The patient was discharged improved on January 2, 1900, again with a diagnosis of probably intra-thoracic tumor.

On several occasions during the spring of 1900 the patient was demonstrated to the students at the out-patient clinic. The absence of all signs of aneurism and of enlargement of the glands, the negative character of the X-ray picture, the slow course of the disease, led to the diagnosis of fibroid obliteration of the superior vena cava.

He was admitted for the third time on June 20, 1900, complaining of pain in the chest and in the right arm and of a cough. While away from the hospital he had been comfortable so long as he took care of himself. The cough had lasted three weeks and had been accompanied by much expectoration. The right radial pulse was now distinctly fuller than the left. The veins were more dilated on the right side of the thorax. The right lung was distinctly impaired. Tubercle bacilli were found on June 23. The expectoration was muco-purulent in character and very foul. There was a great deal of insomnia due to the cough. The patient insisted upon

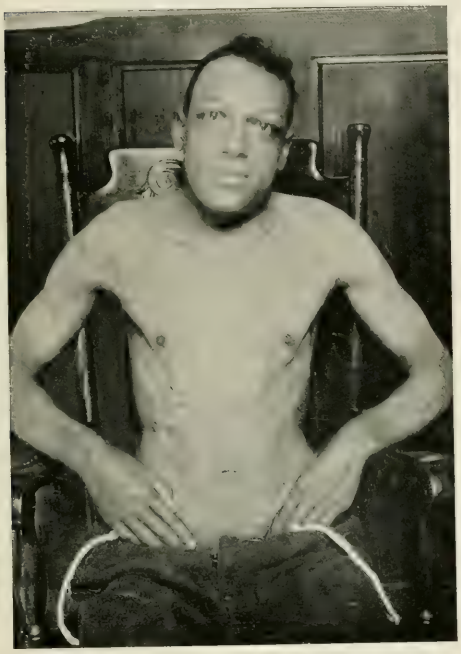


FIG. 1.

femorals. The dissection reveals the following condition of the venous system: The right jugular and the right subclavian, much dilated, formed the right innominate, which is immediately obliterated to form a dense thick cord. The right internal mammary is obliterated at its junction with this innominate. The left internal jugular is obliterated, or partly so, in the neck. It joins the left subclavian to form again a fibrous mass which represents the innominate on the left side. The two innominates unite to form a fibrous mass which represents the superior vena cava (Fig. 2). Within the pericardium, however, this vessel is patent from the point where it receives the wide azygos vein to the heart, but it is not more than 15 mm. wide and its walls are quite thick. The azygos vein is 1 cm. in diameter, and there is no obstruction at its mouth. The anterior perforating branches of the internal mammary are very wide and connect with the long tortuous subcutaneous veins. The superficial brachial veins communicate similarly with these tortuous veins, forming a pre-pectoral anastomosis (Fig. 3). The tortuous veins communicate with the superficial and probably with the deep pectoral veins in the inguinal region. The sinuses in the cranial cavity are dilated and contain non-adherent thrombi. The left jugular vein being occluded, blood from the head must have passed out mainly by way of the right jugular, through the right subclavian, through the pre-pectoral anastomosis with the anterior perforating branches of the internal mammary and with the subcutaneous tortuous veins to the superficial epigastrics and thence to the inferior vena cava, which was normal throughout its course. An alternate course would have been from the subclavian to the upper right intercostal veins through the perforating branches of the latter and thence to the azygos, which was very large (12 cm. in diameter). On the left the blood from the subclavian vein followed a similar course. The obliterated portions of the innominate and jugular veins lie as a firm mass of fibrous tissue firmly adherent to the spinal column. Peritoneum and pericardium normal.

Lungs: Both adherent to the pleura at the apices; bronchial glands enlarged; considerable œdema present. Many tubercles at each apex and throughout the lung. A cavity 2 cm. in diameter present in the right lung. Between the tubercles the intervening lung is scarred, but there is no pneumonia. Both lungs are adherent to the vertebral column at their upper portions.

Spleen: Substance is pale and flabby.

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Stomach, pancreas, kidneys, testes normal.

Vertebræ: Removal of the fibroid mass surrounding the innominate veins reveals an erosion of the centra of the last cervical and the first two or three thoracic ventebræ, with complete denudation of the bone. There is a focus of disease in the last cervical and first thoracic vertebral centra. These have collapsed and caused a slight skoliosis and possibly some kyphosis. The cavity thus formed extends into the spinal canal but causes no special compression of the cord. The adjacent centra are much eburnated. The fibrous tissue lying upon this cavity in the vertebræ is continuous with that about the innominate veins. There is no marked abnormality in the cranial vessels. The pia, especially in the fissure of Sylvius about the cerebellum, the base of the brain and the medulla, shows many miliary tubercles. The lateral ventricles are slightly distended with fluid. The ependyma shows a fine granulation.

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He was admitted for the third time on June 20, 1900, complaining of pain in the chest and in the right arm and of a cough. While away from the hospital he had been comfortable so long as he took care of himself. The cough had lasted three weeks and had been accompanied by much expectoration. The right radial pulse was now distinctly fuller than the left. The veins were more dilated on the right side of the thorax. The right lung was distinctly impaired. Tubercle bacilli were found on June 23. The expectoration was muco-purulent in character and very foul. There was a great deal of insomnia due to the cough. The patient insisted upon

leaving the hospital on June 25. Fig. 1 shows the distension of the superficial veins.

The fourth and last admission was on February 16, 1901, when the patient came in complaining of cough which had lasted three weeks. He had been spitting blood at intervals for a year and had night sweats. His appetite was poor, and he had had a good deal of vomiting. He had also had constipation. Two days after admission tubercle bacilli were again found, and the condition of the right lung was worse than on the previous admission. His cough was racking and very severe. On February 31 he became noisy and profane and refused to keep on his clothes, and during the afternoon was found lying on the floor, and irregular convulsive movements of the extremities were noted, and the patient was apparently unconscious. The temperature rose to 102.6°. On being put to bed the patient kept making peculiar grimaces, but soon became rational and did not remember the period of unconsciousness. His speech was distinctly thick like that of a drunken man. On February 24 the patient became restless; there was marked cyanosis of the face and extraordinary injection of the conjunctivæ; there was definite nystagmus; the pupils were unequal, the left being larger; there was frothing at the mouth. The dilatation of the veins had become appreciably greater. Later in the day the cyanosis increased. Bleeding was resorted to and temporarily quieted the patient. The respirations were very stertorous throughout the day. Soon after midnight, after a violent convulsive attack, the patient became quieter and died at 1.50 a. m. on February 25.

Lumbar puncture was done at the time of death and the fluid showed leucocytes and tubercle bacilli.

Autopsy by Dr. MacCallum on February 25, 1901, nine hours after death.

Anatomical Diagnosis.—Chronic tuberculosis; tuberculous caries of spine; fibrous tissue growth in the adjacent regions, with involvement and occlusion of vena cava superior and of innominate veins; establishment of extensive collateral venous circulation; tuberculous meningitis.

The body of a young negro, 170 cm. long. Over the anterior thoracic and abdominal regions, reaching down to the inguinal regions, there are many tortuous and distended subcutaneous veins. To facilitate the dissection of the venous system hot water and then colored wax were injected into the femorals. The dissection reveals the following condition of the venous system: The right jugular and the right subclavian, much dilated, formed the right innominate, which is immediately obliterated to form a dense thick cord. The right internal mammary is obliterated at its junction with this innominate. The left internal jugular is obliterated, or partly so, in the neck. It joins the left subclavian to form again a fibrous mass which represents the innominate on the left side. The two innominates unite to form a fibrous mass which represents the superior vena cava (Fig. 2). Within the pericardium, however, this vessel is patent from the point where it receives the wide azygos vein to the heart, but it is not more than 15 mm. wide and its walls are quite thick. The azygos vein is 1 cm. in diameter, and there is no obstruction at its mouth. The anterior perforating branches of the internal mammary are very wide and connect with the long tortuous subcutaneous veins. The superficial brachial veins communicate similarly with these tortuous veins, forming a pre-pectoral anastomosis (Fig. 3). The tortuous veins communicate with the superficial and probably with the deep pectoral veins in the inguinal region. The sinuses in the cranial cavity are dilated and contain non-adherent thrombi. The left jugular vein being occluded, blood from the head must have passed out mainly by way of the right jugular, through the right subclavian, through the pre-pectoral anastomosis with the anterior perforating branches of the internal mammary and with the subcutaneous tortuous veins to the superficial epigastrics and thence to the inferior vena cava, which was normal throughout its course. An alternate course would have been from the subclavian to the upper right intercostal veins through the perforating branches of the latter and thence to the azygos, which was very large (12 cm. in diameter). On the left the blood from the subclavian vein followed a similar course. The obliterated portions of the innominate and jugular veins lie as a firm mass of fibrous tissue firmly adherent to the spinal column. Peritoneum and pericardium normal.

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CASE II.—*Hodgkin's Disease; Compression of Superior Vena Cava; Extensive Collateral Circulation; Formation of Phleboliths; Unusual Chronic Course; Autopsy.*

M. H., aged 31, varnisher, applied at the Medical Dispensary, October 4, 1889, complaining of swelling of the neck and of the face. Family history is good. None of his relatives have had any glandular enlargements.

He himself has always been well and strong, with the exception of the usual diseases of childhood.

About 1884 he first noticed swelling of the glands of the neck, chiefly on the right side. It did not increase much, but shortly afterwards he noticed the glands on the left side were a little large. They, however, did not interfere with his work. Throughout the year 1887 there was a decided increase in the glandular enlargement, and about Christmas of that year the face was a good deal swollen and the veins of the face and of the arms and front of chest began to swell. He also

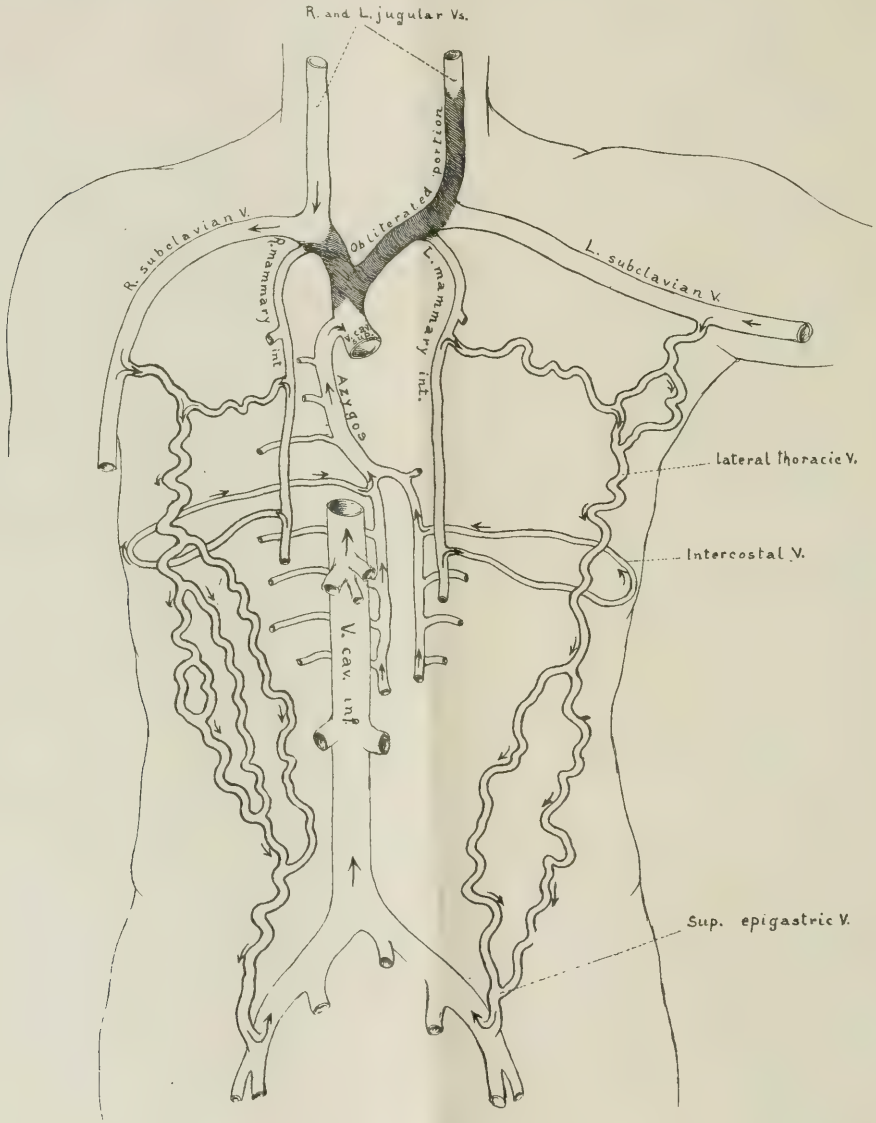


FIG. 3.



Fig. 2.

had shortness of breath on slight exertion. Through last year and the present year this condition has persisted. The glandular enlargement has been progressive; the swelling of the veins very marked, and on exercise he gets extremely livid.

On October 4, 1889, I dictated the following note: The patient is a small, spare man; the face is greatly suffused and swollen, the conjunctiva moist and injected, and about the lips and cheeks there is slight lividity. The tongue also is somewhat cyanosed. The venules are prominent and the veins of the cheeks and forehead are distinct. There is great enlargement of the glands of the neck, particularly on the right side. They are firm and hard, extending on both sides of the sterno-mastoid muscles and reaching to the clavicles, the outlines of which are obliterated by the swelling. The axillary glands are not enlarged. When stripped the most striking feature is the enormous distension of the thoracic and abdominal veins. The manubrium looks prominent and the first and second interspaces near the sternum look full. Beneath the skin of the sternum and over the whole front of the thorax large veins can be seen, and on palpation there is felt a soft plexus of distended vessels. Palpation causes great pain over the manubrium and the first and second left interspaces.

On percussion there is absolute flatness on the manubrium, extending into the infra-clavicular space and as low as the nipple, where it is continuous with that of the heart. The dulness extends only about two inches from the sternal margin. The apex beat is neither visible nor palpable. Percussion is clear on the right side in front and on both sides behind.

On auscultation, the heart sounds are clear, the aortic second accentuated; no murmur in aortic region or at apex. Respiration is very feeble and distant in left infra-clavicular and mammary regions. The radials are equal. There is no lividity of the hands; no enlargement of the veins; no clubbing of the fingers.

The abdomen looked full and beneath the skin there could be seen the superficial epigastric veins enormously distended; the right one almost as large as the index finger. The blood current in them is from above downwards.

The patient was placed upon Fowler's solution, minims v, to be increased. From this time until his death, 1893, that is for fully three years and a half, this patient was under our observation, and I showed him repeatedly at the clinics, and once at the Hospital Medical Society.

I will note here some of the special features in his case as dictated by me at different periods.

December 7, 1889, venous engorgement not so marked. He has had two smothering attacks at night and has had blood spitting.

January 18, 1890, he was better, the glandular enlargement was not so marked, eyes not so suffused. He has been taking Fowler's solution of arsenic up to 15 minims three times a day and has had a little diarrhœa. The swelling of the glands has distinctly lessened. He has a good appetite.

February 25, 1890, the note is: Feels very well; has improved wonderfully; scarcely any more swelling on the right side than on the left; the glands of the lower part of the neck are still enlarged, and only slightly tender. Difference in the pulses still apparent.

March 24: Glandular enlargement even smaller than before; less tender. He has had a distressing papular eruption on the face, hands and neck, which itches very much. Throughout the summer he improved a great deal and felt very much stronger.

On September 4 I dictated the following note: There is a red papular rash which itches. The swelling on the right side of the neck is still painful to the touch. Though the swelling in the neck has diminished, the cervical glands are still enlarged; the distension of veins over the front of the chest is now enormous, extending on either side to the nipple line; the epigastric veins are also enormously enlarged and plexiform. In some of the larger veins over the manubrium thrombi are to be felt. The large cutaneous veins extend over the right shoulder and biceps. The face is still suffused, but not nearly so much as before. The dulness persists over the manubrium and the left infra-clavicular space. Heart sounds are clear; there is no murmur; no venous hum. There is very marked difference between the breath sounds in the left and right infra-clavicular regions; in the former they are scarcely audible.

Throughout the year 1891 he was frequently under observation and there was very little change. I examined the heart repeatedly. There was never any venous hum, never any murmur. He took the Fowler's solution at intervals; towards the end of the year he had some pain in the left arm and the left side of the chest.

On April 5, 1892, I made the following note: General condition remains unchanged, though the glands of the right side of the neck are now not very much swollen. They are well marked on the left side. The sternum is perhaps more prominent, but it is difficult to say whether this is due to increase in the bone itself or to the enormous veins in the subcutaneous tissue. The skin is not abraded or reddened. The plexuses of veins already referred to is very marked. Just under the left nipple one of the larger veins contains a thrombus and higher up towards the manubrium there are several phleboliths the size of peas. The right epigastric vein is still larger. There is a slight heaving of the whole chest with each cardiac impulse. The heart sounds are clear, aortic second not accentuated. No venous hum over the plexus. Face a little suffused; no change in the pulmonary condition.

In July the patient had a hemorrhage, stated to be from the lungs. In September he said that he had been fairly well all summer and had tried to do a little work. The face was

congested and full; the glands on the right side of the neck still considerably enlarged. The superficial epigastric veins were distinctly smaller, but there seemed to be no change in the condition in those of the sternum. Early in January I showed the patient at the clinic. The condition was practically the same, though the epigastric veins were certainly not quite so large.

The patient died in March, 1893, and an autopsy was obtained by Dr. Flexner, but under most unfavorable circumstances, and the thoracic organs had to be hurriedly examined, so that no complete dissection could be made in situ. The superior cava was completely obliterated by the enlarged mediastinal glands.

Summary of Cases.

(Cases from the literature of fibroid obliteration of the superior vena cava, collected by Dr. E. H. Hume.)

A. Thrombosis due to disease within vein.

I. (a) Phlebitis.

1. Breschet: Traité des maladies des artères, &c., Paris 1819 (translation of Hodgson's Diseases of Arteries), No. 150; Preparation in Museum of Faculty of Medicine, Paris; a wax model made under direction of Dupuytren. Thrombosis of vena cava superior.

2. Wolff: Mag. f. d. ges. Heilk., Berlin, 1823, XIV, 570. Female, 19; sarcoma of shoulder. P. M., inflammation of right auricle and pericardium; thrombosis of vena cava superior.

3. Claverie, G. E.: Thèse de Paris, 4°, 1858. Male, 52, jeweler; onset of symptoms gradual, lasting thirty years; gout three years previously; death from gangrene of foot following gout. P. M., vena cava a fibrous cord; pericardium adherent; lungs, chronic phthisis.

4. Rees: Lancet, 1860, II, 585. Female, 48; œdema of upper and lower extremities. P. M., complete obliteration; thrombosis of vena cava superior, evidently phlebitis; disease evidently propagated from right auricle.

5. Rees: Guy's Hospital Reports, 1861, 3. s., VII, 113. Female, 54; heart disease. P. M., entrance to vena cava superior obliterated by phlebitic thrombi.

6. Wilkins: Lancet, 1883, I, 812. Male, 34, naval officer; strain twelve months previously. P. M., thrombosis with complete obliteration of vena cava superior.

7. Garcia Rijo: Crón. méd. quir. de la Habana, 1887, XIII, 412. Male, 38, soldier. P. M., complete obliteration of vena cava superior by thrombosis.

8. Hirschlaff: Inaug. Diss., Berlin, 1893. Female, 51; diphtheria at eighteen; rheumatism at twenty. P. M., mitral stenosis; aortic and mitral insufficiency; marantic thrombosis of vena cava superior, with complete obliteration.

(b) Propagated Thrombus.

9. Duchek: Prager Vierteljahrsschrift, 1854, XLI, 109. Pathological specimen in Museum at Vienna. No clinical history. Vena cava superior obliterated by thrombus propagated from periphery.

(c) Tuberculous Endophlebitis.

10. Banti: Sperimentale, Mem. Orig., Firenze, 1891, XLV, 408. Male, 46; carpenter; death from acute miliary tuberculosis. P. M., vena cava superior a hard cylinder; a vegetative mass occupying the auricular entrance to vena cava superior; microscopically, tuberculous endophlebitis.

B. Thrombosis due to disease without the vein.

I. Tuberculosis.

11. Tonnelé: Jour. Hebd. de Méd., 1829, V. Male, 2; cough, diarrhœa, vomiting. P. M., complete obliteration; encysted tuberculous mass, caseous at centre, connected vertebræ to vena cava superior and obliterated the latter; thrombosis of superior longitudinal sinus propagated to vena cava superior.

12. Reid, J.: Edinb. Med. & Surg. Jour., 1835, XLIII, 297. Female, 40, of irregular habits. P. M., vena cava superior a cartilaginous cord connected to right bronchus. Process probably originated in tuberculous bronchial glands.

13. Paulus: Oesterreich med. Woch., 1842, 2 quartal., No. 14. Clinical history not given. P. M., secondary caries of right petrous bone; complete obliteration of vena cava superior by propagated thrombus.

14. Duchek: Loc. cit. Male, 52. P. M., vena cava superior obliterated and attached by fibrous tissue to right bronchus. The process evidently originated in a tuberculous gland.

II. Mediastinitis (unclassified).

15. Oulmont: Mem. Soc. Méd. d'obs., Paris, 1856, III, 391, 468. Female, 49, cook. P. M., a fibrous mass in mediastinum attaching bronchial gland to left bronchus and vena cava superior; vena cava superior completely thrombosed.

16. Habershon: Lancet, 1875, II, 837. Male, 37, coal-heaver. P. M., complete obliteration; chronic mediastinitis leading to fibrous transformation of vena cava superior; evidently congenital, certain valvular defects being present.

17. Williams: Proc. Path. Soc., Dublin, 1877, n. s. VIII, 8. Female, 27; rheumatism eight years before. P. M., vena cava superior a fibrous cord, probably due to inflammation around mediastinal glands.

18. Roberts: Lancet, 1893, II, 1386. No clinical history.

P. M., complete obliteration; fibrous transformation of vena cava superior, probably due to mediastinitis.

III. Aneurism.

19. Martin-Solon: Arch. de Méd., 1836, 2. s., X, 296, Female. P. M., enormous aneurism of aorta; vena cava superior obliterated in walls of sac.

20. Duchek: Loc. cit. Male, 39. P. M., vena cava superior obliterated and lost in the walls of an aneurismal sac.

21. Watson: Practice of Physic, Ed. Condie, 1866, 798. Male, 33. P. M., complete obliteration, vena cava superior being lost in walls of sac of an aneurism of aorta.

22. Russell: Medical Times and Gazette, 1871, II, 130. Male; injury to chest three years previously. P. M., complete obliteration; vena cava superior lost in walls of sac of huge aneurism of aorta.

IV. Syphilis.

23. Willigk: Prager Vierteljahrsschrift, 1853, XXXVIII, 20. Female, 44, laborer. P. M., complete obliteration; fibrous vena cava superior included in syphilitic scar tissue in right bronchus.

24. Duchek: Loc. cit. Female, 47. P. M., Vena cava superior obliterated and attached by fibrous scar tissue, evidently syphilitic, to right bronchus.

25. Fraenkel: Deutsche Med. Woch., 1891, XVII, 1378. Male, 45, history of syphilis and alcoholism. P. M., complete obliteration; compression of vena cava superior by mediastinal syphilitic granuloma; thrombosis of vena cava superior.

V. Periaortitis.

26. Rigler: Wien Med. Woch., 1858, VIII, 1. Male, 70; painter; rickets and typhoid; acute rheumatism often after 28. P. M., dilatation of aorta; periaortitis; thrombosis of vena cava superior.

27. Meigs: Transactions of the Coll. of Phys., Phila., 1886, 3. s., VIII, 13. Male, 72; general arterio-sclerosis; sudden vertigo on day of admission. P. M., complete obliteration; mediastinitis and periaortitis, leading to thrombosis of vena cava superior.

VI. Carcinoma.

28. Barth: Bull. soc. anat., Paris, 1853, XXVIII, 4. Female, 36, healthy, 5-para. P. M., cancer of lung and heart; vena cava superior obliterated by organized clot from the auricle upwards.

VII. Fibroma.

29. Pastau: Virch. Arch., 1865, XXXIV, 236. Female, 42. P. M., fibroma pressing on innominate artery and vena cava superior; complete thrombosis of vena cava superior, with calcification of walls.

A NEW METHOD OF HEMO-ALKALIMETRY AND A NEW HEMO-ALKALIMETER.[1]

By Arthur Dare, M. D.

Numerous methods have been devised from time to time for the purpose of studying the concentration of alkali in the blood; most of these devices employ litmus, lachmoid, erythrosin, or some other one of the chemical indicators, and require for their application a volume of blood only procurable by the scalpel or cupping-glass.

While results fairly approximate may be obtained with color indicators they are not sufficiently accurate to determine the delicate variations required to render the results of value, owing to the fact that laked blood placed upon alkalin (blue) litmus or lachmoid paper, appears red from the presence of hemoglobin and not unlike that of acid litmus; hence the danger of confusing the two phenomena.

As an illustration of the inaccuracies of tests based upon the appreciation of vague colors, we may take our experiment of titrating the blood with tartaric acid. As the reagent is added cautiously, the color intensity is reduced by dilution, but the brilliancy of the hemoglobin is retained; but when the basic principal of the blood is entirely neutralized, the pink color of diluted hemoglobin changes to a straw yellow. This color change, however, cannot be observed in spleno-medullary leukemia, owing to the turbidity of the blood occasioned by a great leukocytosis, the refraction of the leukocytes obscures the brilliant red of the hemoglobin, and the blood and water mixture appears milky rather than red.

I desire to present for consideration a means for determining the neutralization of the blood at an exact and definite point; a method free from the inaccuracies of test papers prepared chemically by an excess of acid or alkali above the neutral point, and one that does not react solely to certain of the complex ingredients of the plasma but shows the point of neutralization of the whole blood.

Blood when examined with the spectroscope gives the characteristic spectrum of oxyhemoglobin, unless changed by the absorption of certain gases or the introduction of substances that modify the composition or functional conditions of the plasma. Under these conditions, the blood spectrum may be altered to that of methemoglobin, carbonyl or carbon monoxide hemoglobin, etc.; but the presence of hemoglobin is still evident by the characteristic spectra. In the case of oxyhemoglobin two dense shadows appear in the highly colored field of the spectroscope, as parallel absorption bands between D and E of Fraunhofer's lines, the line nearest to D is darker, narrower and more strongly marked; that next to E is less sharply defined and broader.

[1] Read before the Johns Hopkins Hospital Medical Society, April 6, 1903.

As the blood is diluted and examined spectroscopically in a stratum of a certain thickness, the absorption bands of oxyhemoglobin are observed to fade away, but are made to reappear when this stratum thickness is increased. When, however, blood is titrated with an acid reagent, the spectrum of oxyhemoglobin disappears and cannot be restored by the addition of an alkali or by increasing the stratum to the maximum, which is capable of illumination for examination spectroscopically, hence the spectrum of oxyhemoglobin may be removed by dilution or by neutralization, in the latter case the hemoglobin is changed and its characteristic spectrum is destroyed permanently, while in the former it can be made to reappear by increasing the concentration of the hemoglobin.

Upon this observation our method is based, yet it will not modify the results as an indicator whether the absorption bands of oxyhemoglobin disappear at the exact point of neutralization or beyond, as it requires a definite amount of acid to cause their disappearance, as can readily be shown by the experiment of adding alkalies or acids to the blood mixture under examination and again titrating, the result being anteceded or delayed by the increase or decrease of alkalinity artificially modified. Therefore we have in the blood *a natural indicator* observed with the spectroscope up to the exact point of departure, which we assume is the point of neutralization; but which cannot be verified by the usual chemical procedures owing to the fact that blood does not give an alkalin reaction to litmus, lackmoid or other color indicators, unless some procedure is introduced that sets the alkali free from its combination in the plasma.

The hemoglobin concentration of the plasma would possibly determine the point of neutralization (or decolorization of the hemoglobin), were all specimens of blood of uniform reaction, but as a certain amount of basic material is to be neutralized before the hemoglobin becomes decolorized, the point of departure is dependent upon the alkalin principle, rather than the quantity of the hemoglobin.

The combination of acid with the basic principles of the blood probably generates carbon-dioxide, which has been thought to decolorize the hemoglobin, but experiment teaches that this is not the case. A blood and water mixture subjected to the direct and continuous flow of carbon-dioxide for an hour failed to modify the alkalinity or to change the color concentration in the slightest degree, hence the carbon-dioxide formed by combination in no wise influences the uncombined principles of the plasma, which are only neutralized by the direct action and combination of the acid reagent.

The final result of volumetric estimation is more precise when a large volume of acid reagent is employed for neutralizing the basic principles of the plasma, permitting as it does of a wider range of measurement and therefore of more conclusive deductions.

In the method suggested by Engel, normal blood is neutralized by 0.5 cc. of acid reagent while our method requires 2.0 cc. for the same purpose, hence Engel divides his result by five while we divide by twenty; naturally the latter method possesses the essential advantage of determining slight variations. When desirable, the result can be still further divided by titrating with a reagent one-half the strength as the one employed; namely, 1/200 of the normal.

Advantage not only to the patient, but also to the hematologist, is derived from the quantity of blood required for an observation. Only one-fourth the quantity of blood necessary for Engel's instrument is needed for an application, as but one small drop is required, while the capacity of Engel's pipette is so great that a drop sufficiently large will rarely adhere to the skin and without assistance it will be necessary to reapply the pipette; this is especially true of profound anemia, when it is often difficult to obtain enough blood for a complete study of the same specimen or to obtain a proper sized drop owing to the lessening of the viscosity of the plasma.

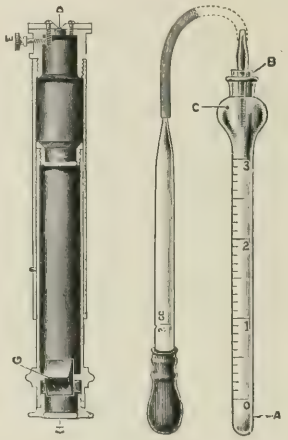


FIG. 1.

Hemo-alkalimeter about one-half actual size. A. Alkalimeter tube. B. Automatic blood pipette. C. Opening for the admission of air. D. Cleft of spectroscope, into which the alkalimeter tube is placed at the point of A. E. Cleft adjustment. F. Diaphragm to intercept reflected light. G. Nicol prism. H. Eye piece.

In selecting a reagent, we were influenced entirely by the merits of various acid reagents; rather than the results of combination with the complex and doubtful composition of the blood.

The concentration of acid in solutions of acid phosphoric varies, and standardization is necessary whenever it is employed, owing to its affinity for water.

Oxalic acid contains a greater amount of water of crystallization and hence is more efflorescent than our reagent, acid tartaric, which contains no water of crystallization and is therefore more uniform in quantivalence value. The mineral acids while probably more permanent in aqueous solutions are open to the objection that the concentration varies to such an extent that they require standardization whenever a reagent is to be prepared.

Description of Instrument.—The hemo-alkalimeter is made up as follows: The first part (Fig. 1, B) consists of a glass stopper through which passes an automatic capillary blood pipette containing 20 cmm. by volume or 15 mgs. by weight (of normal blood), the exposed end of which is ground to a tapering point. The caliber of this little tube remains the same throughout. It may be remarked that a thick glass is used in the manufacture and presents the advantage of being so ground as to afford a magnifying surface, in this respect resembling the clinical thermometer. This stopper and the contained blood pipette are fitted into a clear glass test tube (Fig. 1, A) containing 3 cc., the upper end of which is expanded into a bulb containing on its side a minute opening (Fig. 1, C) for the purpose of admitting air. The top of the bulb is placed close to the stopper, allowing the capillary tube to pass to the center of the bulb, this situation being selected as preventing an adherence of the blood between the sides of the test tube and the capillary pipette. The test tube is graduated in cubic centimeters, and the equivalent in mgs. of NaOH to 100 cc. of blood also represented.

The second part of the instrument, *the reagent pipette*, consists of an appliance made of a glass tube terminating with a rubber bulb and having at its other extremity a piece of rubber tubing which fits over the sharpened end of the capillary blood pipette previously described. In conjunction with this instrument, a spectroscope should be used, the Browning pocket spectroscope answering all purposes.

The test solution to be employed is made up as follows:

Acid tartaric (Merck's reagent), gr. j.gm. .075
Alcohol, ʒ v .....cc. .20
Aqua destil., q. s., ʒ vj.....cc. .200
0.375 to a litre 1/200 of normal.

The alcohol is added to prevent the formation of fungus growth, but not in sufficient quantity to precipitate the albumin of the blood in any morbid condition.

Method of Employing the Instrument.—A drop of blood is obtained from the finger tip or lobe of the ear in the usual manner. The test tube is held horizontally, and its contained blood pipette fills automatically by capillary attraction when the sharpened end is touched to the blood-drop as it emerges from the wound. With an ordinary minim pipette, with a piece of rubber tubing over the free extremity into the test tube, wash this column of blood with distilled water up to the point 0 (zero), which is the first division from the bottom, holding the test-tube vertically. Close the opening in the bulb of the test tube with the thumb and invert the tube several times, to cause a thorough mixing of the blood and water. The *reagent pipette* is filled with the acid reagent, and the rubber tubing is fitted over the sharpened end of the blood pipette; by compressing the rubber bulb the acid solution is forced through the pipette into the test tube, the aperture in the glass bulb being closed before the pressure is relaxed to prevent the mixture of the acid solution and the blood. Having done this, the test tube is inverted several times while still being attached to the reagent pipette, care being exercised to keep the reagent pipette in a vertical position, to avoid a gravitation of the acid solution into the rubber bulb of the reagent pipette, thus preventing a chemical action upon the rubber nipple with the formation of a flocculent precipitate. The interval (Fig. 1, A) between the closed end of the tube and the first marking, 0, should be placed in the cleft of the spectroscope (Fig. 1, D) and observations be taken as to the existence of bands of oxyhemoglobin. Should these bands be present the careful addition of acid solution is necessary. As the bands become fainter and fainter we know that we are approaching the point of neutralization, and it becomes necessary to add the acid, one drop at a time; then invert the test tube and examine with the spectroscope as before. After performing several tests with this instrument it will not be necessary to apply the spectroscope so frequently to determine the point of neutralization, as the eye quickly learns to detect this characteristic change by the color of the blood mixture. When the bands of oxyhemoglobin suddenly disappear the observation is at an end. It is then only necessary to read the result from the scale on the test-tube, which is graduated in cubic centimeters and the equivalents expressed in milligrams of sodium hydrate to 100 cc. of blood.

As a uniform light is necessary for physiological experiments, artificial illumination should be selected as being always available; an open gas-light was employed in our experiments entirely, and the relation of the spectroscope to the source of illumination kept always constant.

The scale of equivalents computed from a basis of 15 milligrams of blood to 2 cc. of acid solution, 1/200 of the normal, is as follows:

cc. of reagent	Mgs. of NaOH to 100 cc. of blood
2.6	345
2.4	319
2.2	292
2.0	266
1.8	239
1.6	212
1.4	176
1.2	159
1.0	133
0.80	96
0.60	79
0.40	53
0.20	26.6

It is not customary to express the alkalinity of blood by the quantity of acid required for its neutralization, but in milligrams of an alkali, sodium hydrate being generally selected for the purpose. The calculation will be as follows: The equivalent weight of tartaric acid $\frac{H_2C_2H_4O_6}{2} = 149.64$. Tartaric acid being dibasic, one-half the number of molecules

are taken to make a normal solution which equals 75 grms. (approximately) to a liter; for the present solution there is taken 1/200 of the normal, which is equivalent to 375 mgs. to a liter. Sodium hydrate has 40 atoms to its molecule, which gives an equivalent of 40 grms. to a liter, therefore 1/200 of the normal tartaric acid solution is equal to 40/200 or 200 milligrams, and each cc. of acid solution will give an equivalent of 0.0002 mgs. of the alkali.

Every 100 cc. of blood will equal 266 mgs. of sodium hydrate.

The usual method of obtaining the results is to estimate by mathematical calculation the amount of alkali present in the blood; but this method has always proved itself to be both tedious and inconvenient, as it requires a decided tax on the memory to recall the various estimates as a working basis. In place of this rather intricate method, I would like to offer the following as its substitute: I have devised for this purpose a scale of equivalents, in mgs. of sodium hydrate to 100 cc. of blood. Thus, should we employ 2.2 cc. of reagent, the alkalimeter tube would indicate an equivalent of 292 mgs. of sodium hydrate to 100 cc. of blood.

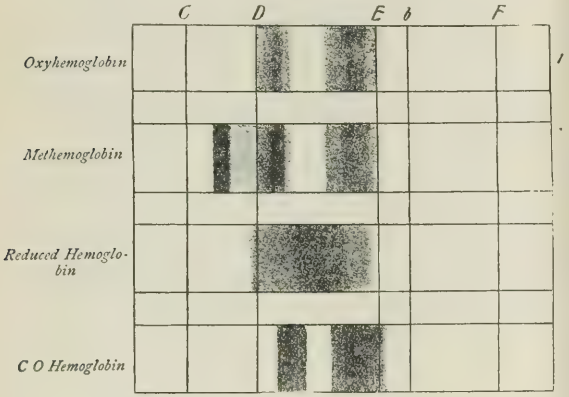


FIG. 2.

Very little can be added to the present knowledge of the alkalinity of the blood, beyond what has been learned from a study of a few cases. There is a more or less constant relation of the alkalinity of the blood to the color index, and our deductions are drawn principally from this discovery.

If this relation is borne out by the experiments of other investigators, we have at least a reliable basis upon which to make comparisons. The reason why the results obtained by different experimenters differ so widely is at once apparent, for as the disease progresses the color index changes with the varying relation between the number of erythrocytes and the hemoglobin. Even under physiological conditions marked variations of color index and alkalinity occur. The same pathological process in one case or in a series of cases, at various periods, gives diverse results; but should a definite relation between the color index and the alkalinity be established, we have a means by which the alkalinity can be studied even with the ever changing conditions of the plasma.

For sake of illustration a few cases are recorded to exhibit the relation between color index and the alkalinity in various morbid conditions. Many more cases were examined, but only those included, which were confirmed by clinical or laboratory methods, by surgical procedures and by post-mortem studies.

The alkalinity was included in the routine blood examinations made in Jefferson College Hospital by Dr. John Funke, resident pathologist, to whom I am indebted for the report of the 75 cases here presented; the table seems sufficiently interesting to merit a closer study of the relation of the alkalinity to physiological and pathological alterations of the blood.

From the seventy-five cases here tabulated it would be difficult or impossible to arrive at any definite or accurate conclusions, owing to the limited number of the cases under observation. In enteric fever a marked decrease in alkalinity is the rule. Thus, in 23 cases where a clinical diagnosis of enteric fever was made, it was discovered that in 20 of them the alkalinity of the blood was normal or below normal. As the tests were made at the time that the blood counts were asked for (regardless of the duration of the disease) it would be impossible to offer any explanation as to the exact period when the decreased alkalinity manifested itself.

A decrease in the alkalinity is likewise observed in tuberculous disease with glandular involvements, while with the existence of tuberculous meningitis or peritonitis the alkalinity shows an increase or falls late in the course of the affections.

In gastric ulcer there is a fall in the alkalinity below the color index, while gastric cancer shows an alkalinity above the color index. It may be here stated as a general fact that in all malignant conditions the alkalinity of the blood was found to be normal or else to have shown some increase in its alkalinity.

The anemias exhibited a decided fall in alkalinity, while observations upon chlorotic subjects showed the alkalinity to follow closely the normal color index. In the latter disease attempts were made to increase the alkalinity by the administration of excessive amount of sodium bicarbonate; and, while there was noted an increase in the erythrocytes and the existence of a turbid and alkaline urine, the hemoglobin failed to respond to the test, nor did the alkalinity rise above the normal; in other words, the previous existing relation between the alkalinity and the color index was still preserved.

In splenomedullary leukemia the alkalinity suffers a marked decrease, while in splenic anemia and also in cholemia there appears a rise in the degree of the alkalinity.

Catarrhal jaundice and amyloid liver both raise the alkalinity of the blood; cholelithiasis presented an evident decrease. In a case of abscess of the liver the fall in the alkalinity was most pronounced (123 mgs. to 100 cc. of blood).

Croupous pneumonia, phthisis, influenza, rheumatic fever, rubeola, appendicitis (acute and catarrhal), even in the pres-

TABLE.

Disease.	Above. Normal Alkalinity. Below.	Erythrocytes.	Leukocytes.	Per ct. hemoglobin.	Color index.	Alkalinity.	Widal reaction or .	Per ct. urea.
Enteric fever		5,240,000	6,400	85	0.81	1.1		
" "		3,810,000	5,800	63	0.82	1.6	.	
Supposed enteric et chr. bron.		4,590,000	6,400	75	0.81	1.5		
Enteric on admission		4,220,000	12,800	70	0.82	1.65		
Thirty-five days later, temp. norm. 7th day		2,640,000	13,400	69	1.3	1.5	.	
Enteric on admission		4,570,000	16,400	88	0.96	2.3		
" later		5,300,000	9,500	80	0.75	1.5		
"		5,240,000	16,000	68	0.64	1.5		
"		4,460,000	9,400	76	0.85	1.7		
" Mrs. H.		3,700,000	4,000	65	0.87	1.0	.	
" three days later		3,350,000	3,800	54	0.80	0.8	.	
" five days later		3,660,000	3,800	54	0.72	0.1	.	
" Mrs. G.		4,710,000	7,800	74	0.78	1.3	.	
" five days later		4,040,000	8,000	80	0.99	1.5	.	
" Mrs. M.		3,200,000	7,200	69	1.1	0.9		
" Mrs. C.		3,460,000	7,400	70	0.88	1.3	.	
" Mrs. T.		4,980,000	15,900	70	0.70	1.6		
" six days later.		5,150,000	6,600	68	0.66	0.9	..	2
"		3,570,000	9,000	85	1.1	1.8		
"		3,910,000	19,400	86	1.1	2.0		
"		4,516,000	13,400	87	0.95	1.8	.	1.7
"		6,240,000	3,800	79	0.71	1.6	.	1.8
" et pneumonia		4,430,000	13,000	76	0.85	1.2	.	2.4
Chlorosis		4,540,000	9,600	55	0.65	1.2		
"	Treated with	2,950,000	8,400	20	0.34	0.35		
" three days later	enormous doses	3,450,000	5,400	24	0.34	0.5		
" six days later	of sodium	3,390,000	.....	24	0.35	0.6		
" ten days later	bicarbonate.	4,130,000	.....	25	0.31	0.6		
"		4,560,000	.....	27	0.29	0.6		
Splenomed. leukemia		2,880,000	127,000	38	0.65	0.8		2.2
Splenic anemia		4,010,000	3,600	65	0.81	1.8		
Catarrhal jaundice (coag. eight mins.)		4,450,000	11,400	66	0.74	1.6		
" "		4,970,000	10,000	75	0.75	2.1		
Cholelithiasis (coag. eight mins.)		4,770,000	5,800	59	0.61	1.0		
Abscess of liver		1,990,000	90,000	23	0.58	0.3		
Amyloid liver (digitalis poison)		5,230,000	9,700	64	0.61	1.6		
Croupous pneumonia		4,590,000	11,600	67	0.72	1.5		
" " (low temp., fatal)		4,170,000	25,800	60	0.71	1.5		
Pulmonary tuberculosis		4,800,000	10,400	68	0.70	1.55		
Rheumatic fever		4,620,000	.....	60	0.64	1.7		
Influenza		4,530,000	10,800	70	0.76	1.6		
Rubeola		4,370,000	19,000	46	0.52	1.3		
" fifth day		5,300,000	4,000	67	0.63	1.1		
Tertian malaria (morphinism)		3,240,000	4,400	49	0.75	0.5	(Hyoscin)	
" " (recent infection)		5,990,000	8,200	68	0.57	2.2		
Tubercular meningitis		3,900,000	8,200	67	0.98	2.35		
" peritonitis		5,010,000	8,200	68	0.67	1.6		
" twenty-four days later		4,410,000	8,100	68	0.77	1.3		
" peritonitis		3,260,000	13,200	21	0.32	0.4		
" adenitis		4,580,000	6,200	78	0.85	1.05		
" "		4,990,000	13,600	50	0.59	1.1		
" "		4,970,000	9,700	65	0.65	1.1		
Gastric ulcer		3,400,000	13,800	45	0.66	1.1		
" "		3,680,000	3,000	65	0.88	1.45		
" "		2,700,000	6,200	40	0.75	0.9		
" "		3,340,000	7,800	46	0.68	0.95		
Carcinoma ventriculi		4,300,000	6,000	40	0.46	1.1	.	1.8
" of breast		3,550,000	9,000	69	0.97	1.6		
Malignant disease of mediastinum		4,460,000	11,000	60	0.67	1.3		
Mal. dis. of liver, gall-bladder, or pancreas		4,190,000	12,800	55	0.66	1.3		
Sarcoma of thigh		5,230,000	5,950	75	0.72	1.5		
Lymphosarcoma of neck		5,370,000	19,200	76	0.67	2.0		
Carcinoma of breast		3,700,000	14,600	70	0.94	1.9		
Malignant disease of groin		5,310,000	7,200	80	0.75	1.5		
Diabetes mellitus		5,300,000	11,000	85	0.80	1.6		
Parenchymatous nephritis		2,560,000	5,200	33	0.69	0.7	..	0.5
Inflammatory condition of round ligament		3,950,000	14,200	67	0.84	1.5		
Renal calculus		5,470,000	7,600	78	0.71	1.9		
Appendicitis		5,450,000	22,200	90	0.82	1.8		
" catarrhal		5,270,000	8,600	80	0.76	2.1		
Cellulitis (leg)		3,500,000	22,000	25	0.55	0.8		
Appendicitis (fourth day of attack)		6,150,000	13,900	67	0.54	1.4		
Osteitis defor. et int. nephritis		4,950,000	5,800	70	0.71	1.3		
Angioneurotic edema et urticaria		6,350,000	10,400	84	0.66	2.45		
Normal		5,000,000	6,000	100	1.0	2.0		

To determine the relation of the alkalinity to the color index, multiply the color index by two (2); the difference between this result and the cubic centimeters of reagent, required to neutralize the blood, represents the alkalinity above or below the normal (color index.)

ence of a frank leukocytosis, showed an increased alkalinity, while investigations upon malarious subjects appear contradictory. In one case of chronic malaria, where the patient was addicted to the use of morphin, treatment was effected by the use of hyoscine hydrobromate, and the alkalinity was then found (133 mgs. NaOH to 100 cc. of blood) to be subnormal, while on the contrary a recent infection with tertian malaria presented an alkalinity above the normal (133 mgs. NaOH to 100 cc. of blood), the color index in the first being 0.75, in the second 0.57.

The relation that the alkalinity bears to the excretion of urea needs investigation.

Imperfect as have been these studies, they would tend to show that in those diseases which present a marked decrease in the alkalinity, they at the same time exhibit a marked increase in the quantity of urea eliminated or the amount of nitrogenous food is diminished.

JOHN COLLINS WARREN.[1]

By J. G. Mumford, M. D., *Boston.*

Unlike the history of literature or of politics, the history of medicine must be largely an account of men and the lives they led. Good literature produced in the eighteenth century is good literature in the twentieth century. The political acts and motives of our ancestors find their counterpart among us today, and the value of such former things is vital still; but the science of ancient times is no longer our science. With few exceptions that old knowledge is but as the babbling of children in our ears. We cannot take seriously most of the former medical wisdom; but we may honor the men and follow their lives and admit the debt we owe them; for out of their much talking and blind groupings there grew the scaffolding of that edifice which we are now building.

When we come down to the men of our grandfathers' generation these thoughts are not so obvious, because in them we begin to see ideas and motives and acts more modern. But much that they did well has now come to seem very feeble and erring—little worthy of serious study, though doubtless very important and urgent a hundred years ago.

However, the reading of that old medical literature is still very interesting. The acumen of the men, with the dim light they had, is remarkable indeed; their shrewd guessing, their frequent missing and infrequent hitting of the mark make a study of constant pleasure and charm for the student of those times. Yet an account of such hittings and such missings and guessings must form no part of this present writing. The task would be too intricate and lead us into technicalities too far afield. After all, it is the men themselves whom we must observe, and those few things which now and again they did greatly.

Among the men of that generation of our grandfathers few led more steadily laborious and useful lives than did John Collins Warren. He was born in Boston in 1778, on the first of August, the eldest son of that interesting John Warren[2] who served in the Revolution and founded the Harvard Medical School.

If ever there was a man blessed, or cursed, as you choose, with the New England conscience, it was John Collins Warren. His father wanted to keep him out of medicine, and he himself had no natural liking for it. We have it over his own signature that he was indolent and hated study; yet, once having put his hand to the plow, he never turned back, but devoted himself heart and soul, steadily, faithfully, without enthusiasm, to his profession, for more than fifty years. And he certainly had a very marked influence upon general practice in Boston, upon teaching at Harvard, upon surgery at the Massachusetts General Hospital, and upon his professional brethren in this country. Intellectually he was unlike any of the other early American surgeons, though in certain elements of training and experience he might be compared to Valentine Mott of New York. Like Mott, he was the son of a doctor, he was born and reared in an old, well established community, and in a medical atmosphere; he was thoroughly educated for his work and he spent his life in the midst of congenial surroundings, social and professional.

We probably know as much about him as we could know about any man of his temperament; for he had a steady appreciation of his own position in life and took copious biographical notes of his own career; those notes were elaborately edited by his brother soon after his death.

Inheriting a strong position from his distinguished father, he had a constant and proper pride in supporting it, and the combination of a sound understanding, wide culture, laborious industry and eager grasp of opportunity, together with the fortunate circumstance that for many years he met with little serious professional competition, secured for him in early life the unique position of surgical autocrat of New England.

His own biographical notes contain abundant material for a delightful memoir of his times, if only they had fallen into the hands of a Trevelyan or a Lang. Unfortunately, his editor was too much bent on eulogy for the popular success of the book. In spite of these drawbacks, we have a picture of a very important and very full career, and of a man familiar in his day to doctors throughout the land.

[1] Read before the Johns Hopkins Hospital Historical Club, February 9, 1903.

[2] The four generations of surgeons of this well known family are: John Warren, 1753-1815; John Collins Warren, 1778-1856; Jonathan Mason Warren, 1811-1867, and John Collins Warren, 1842, who is still active among us.

Warren's youth was passed in surroundings which seem very ancient to us now. His grandson and namesake has given us a charming sketch[3] of those old days, taking his material from his ancestor's own notes, which run:

"At the period when I left college and became an inhabitant of Boston it was thought necessary to undergo the operation of a barber half an hour every day. This consumed much time, besides the horrid consequences of carrying on one's head a quantity of curls, pomatum, flour, and the long cue or heavy club.

"The dress at that time was a colored coat with metal muttons, usually yellow; colored waistcoat, short breeches, buttoning at the knees; long boots with white tops, and when riding on horseback a pair of leather breeches instead of pantaloons, of drab cloth.

"These yellow breeches were daily cleaned with yellow clay, which required that the coats should never be brought in contact with them. Then a short ruffle at the breast and about the wrists, a white cravat, filled out with what was called a pudding, the use of which, from the effect of habit, could not be dispensed with for some years.

"Cocked hats were very much worn at the time, but not by the young.

"Gentlemen of a certain age wore wigs, which were sent to the barbers once a week to be fresh dressed, so that on Saturday night we saw the barber's boys carrying home immense bundles of wig-boxes as a preparation for going to church on Sunday.

"Physicians who had much business in those days rode on horseback. Riding in a chaise was very rare, and in a four-wheeled carriage still more so. My father rode on horseback till a few years before his death.

"Dr. Lloyd generally drove a very fine horse, and Drs. Jarvis and Whipple were famous for beautiful saddle horses and the elegance with which they rode.

"Large parties opened at 7 or 8 o'clock in the evening, and were much more formal than at present. A friend of mine told me that he saw me dance a minuet in 1796 or thereabouts, and that this was the last time he had witnessed this dance in Boston.

"Persons of a certain age were treated with a degree of deference now wholly disused. In fact, one of the great traits of the manners of the present time is the manner with which young persons are accustomed to treat persons older than themselves.

"Gentlemen's dinner parties began early and ended late. The great care on the part of the host was to present to the guests as much ordinary wine as they could be made to drink, and then to bring forward in succession a variety of old wines, each having a character a little better than that which preceded. All of these had some remarkable history connected with them, the details of which constituted an important part of social discussions.

[3] Reminiscences of An Old New England Surgeon (Maryland Medical Journal, 1901, vol. 44, p. 45), by John Collins Warren, M. D., F. R. C. S.

"On the whole, the dinner parties of those days must be looked on with disgust; for not only was the quantity drunk sufficient to make irreparable inroads on the physical organization, but this indulgence led to coarse extravagance and thought, and the conversation at a dinner party, if taken down by a stenographer and presented to the party on the morning following, would have filled them with shame and regret."

Warren was intended by his father for a mercantile life, but the suitable opening not immediately presenting itself after he left college, he passed a couple of years at French and the *pretended* study of medicine, as he himself says. Then he went to Europe and settled down to serious work—that was in 1799 when he was 21 years old. His course there was much like that of many other young American students of the time. London claimed him first, where he became a pupil of William Cooper, and later of William Cooper's nephew, Astley Cooper. The elder was an able, conservative surgeon, testy and ignorant of all things beyond his little island—he was the antipodes of his brilliant, generous, popular nephew. Warren secured a dresser's position at Guy's Hospital—it was merely a matter of money down—and served at such work and dissecting for something more than a year. Then he went to Edinborough for a year, where he received his medical degree, and then for a final year to Paris. In the two latter places he studied hard—going in for chemistry, general medicine and midwifery, as well as anatomy and surgery. He lived in Paris with Dubois, Napoleon's distinguished surgeon, and studied chemistry with Vaquelin and Fourcrois; anatomy with Ribes, Sabbatier, Chaussier, Cuvier and Dupuytren; medicine with Corvisart, and botany with Desfontaines. That was a brilliant gathering for the edifying of a young gentleman from Boston. He says that the French students were green from the Revolution, for the most part a rude and vulgar set of people, who made him much trouble first and last.

In the autumn of 1802, Warren came home, by the way of England, and on arriving in Boston, found his father in very poor health. In order to relieve him he immediately assumed a great part of his practice. It is said that at this time the elder Warren had a larger private practice in Boston, than any other physician has carried before or since. At any rate the son found himself almost swamped by these new duties, and tells in his diary that frequently during the year he would make fifty professional visits a day. Allowing for a working day sixteen hours, this would give him about twenty minutes to each patient, not counting the time consumed in travelling; and, as much of his work was midwifery, we must think of him as a young man with an extraordinary burden to bear. It is recorded of both the Warrens that they acquired a very great facility in dealing with patients and a remarkable intuitive skill in the diagnoses of the day. Their visits were purely business-like. They would take up the case at once, wasting no time in gossip, and the required duty being completed, would promptly withdraw.

This very sensible method, so unlike that usually followed

by their colleagues, gained them the respect of their patients and saved hours of valuable time, daily.

The fortunate young Warren found other advantages to his hand—not the least among them an opportunity for teaching. His father was finding that work and the ride to the Harvard school in Cambridge were almost more than he could bear, so the son was set to work to relieve him. The Harvard school was still in its infancy. Its distance from Boston made it difficult of access for students living in the city, and there was, of course, an absolute lack of clinical material in Cambridge. At about the time of Warren's coming home, James Jackson also appeared upon the scene, and we find the names of the two men associated thereafter for more than fifty years. They and their contemporaries were joined by the elder Warren, and by Dexter, Professor of Chemistry, in the effort to transfer the school to Boston, and after years of rather bitter conflict with Waterhouse, Professor of Practice, they succeeded in effecting the change in 1810.

Those years between 1802 and 1810, were important years to Warren in many ways. He married a wife, to begin with, in 1803, a daughter of Jonathan Mason, and began the rearing of his many children. He was active in all sorts of literary, social and scientific enterprises. With John Lowell, J. Q. Adams, Kirkland, Quincy, Jackson, William Emerson and others, he started a Natural Philosophy Society; with Gardner, Emerson, W. S. Shaw, Buckminster, Tuckerman, Jackson and others he established the Anthology periodical and the society which grew into the Boston Atheneum; with Jackson, Dixwell, Coffin, Bullard and Howard, he formed a Society for Medical Improvement. In 1806 he was made Adjunct to his father in the chair of Anatomy and Surgery at Harvard, and he succeeded to the full professorship, upon his father's death, in 1815.

Warren's name will always be associated with two important facts. One was the founding of the Massachusetts General Hospital; the other was the introduction of ether anæsthesia. These two events were separated by an interval of twenty-five years, but around them both are grouped nearly all that is conspicuous in Boston medicine during the first fifty years of the last century. There were other men of course, concerned with both events—some of them concerned more intimately than was Warren; but Warren was part of both and for such distinction is known to us.

Before the establishment of the hospital, his constant occupation as a teacher and general practitioner led him into lines of research less strictly surgical than what we know of his work in his later years. In 1809, while still comparatively fresh from European teachers, he published a valuable paper on organic diseases of the heart, a subject, which until then was little understood in this country; and in 1811, together with Jackson, Gorham, Jacob Bigelow and Channing, he assisted in founding the "New England Journal of Medicine and Surgery." This publication was ably edited and in 1828 was united with another, under the title "The Boston Medical and Surgical Journal," which flourishes today.

As a writer, Warren was lucid and strong. He had a great many things to say, and he said them well. His belief was that, as yet, the profession in America was too young and inexperienced for original work of moment. He recognized the inadequate training of the great mass of his fellows, and his conviction was that their first need was to acquire and absorb the learning of the old world. This belief he preached with pen and by word of mouth. He was one of the first to see the true functions of a medical school, and he followed other wise men in insisting upon the establishment of hospitals. His lectures were carefully prepared, and systematically delivered. He was clear and instructive without being eloquent. He lacked the charm and magnetism of his father and uncle, Gen. Jos. Warren, in public speaking, but he was more learned than they and ably carried on the work which his father had well begun.

The Massachusetts General Hospital was slow in getting started. So long ago as 1810, Jackson and Warren organized the movement for its foundation—a movement which had been in the air for many years—if, indeed, it may not be regarded as the direct outgrowth of that great military hospital in Boston, over which old John Warren went to preside in 1777. When that old institution disappeared after the war, the elder Warren missed it sadly, and in all his later life essayed to promote a proper substitute.

At last, on the 10th of August, 1810, these various desires of wise men in Boston found voice in a circular letter signed by James Jackson and John C. Warren, in which they asked their fellow townsmen for subscriptions to a "hospital for the reception of lunatics and other sick persons." Promptly the good work was taken up by prominent men of the laity—James Bowdoin and fifty-five others—citizens of Massachusetts—incorporators under the title "The Massachusetts General Hospital," and the enterprise progressed slowly and substantially, until finally in September, 1821, the first patient was received. Warren was then forty-three years old, and his father had been six years dead, without seeing the long awaited hospital an accomplished fact.

It was to the two men, Jackson and Warren, that we owe the Massachusetts General Hospital, and to this day their names, and the name of Bigelow, are the ones most closely associated with it. From the outset, it was a general hospital, where acute diseases were received, though from the beginning its wards for the insane were removed to a distance, located in Somerville, and named after John McLean, who had contributed towards the foundation, sums amounting to about $120,000.

Until the establishment of the general hospital, there was little opportunity in Boston for study and experimentation on surgical lines, but with the hospital's advent, Warren's career expanded in a fashion unknown even to his father, and in his own careful, methodical and painstaking manner, he proceeded to organize a routine for the surgical staff, in a fashion which has to this day left its impress upon the practice of Boston. Warren was very able, but, unlike many other able men, he was a man of detail. His whole life seems to have been schematic and his hospital practice was made to

correspond with the rest of his life. We have seen that he was keenly alive to his own dignity and position, and this characteristic, which sometimes was found irritating to his equals in the outside world, was made to serve a very useful purpose within the hospital walls. From the outset, his department was conducted on lines of almost military discipline. His colleagues were formally addressed and consulted, and the nicest punctilio was observed between them. His juniors on the staff were required to hold towards him and the other senior surgeons a proper distance and respect; the house staff, as we should call the young graduates who act as assistants, were enrolled as "house pupils," were addressed as "Mister" and were not permitted to assume the title of their doctor's degree until the end of their year of service. Their duties were strictly those of the humblest of assistants, they were given no responsibility beyond the very slightest, and their labors consisted largely in the careful writing at dictation, of voluminous records, and in aiding in the dressing of wounds. To some extent, too, they did assist at operations, though often this work was done by one of the Surgeon's own colleagues. In their turn, the nurses and the servants of the hospital were relegated to the very humblest of positions. The result of all this was a most admirable machine, which once established, ran of itself; and in some measure still runs on, much as it was set going eighty years ago.

The position of a surgical teacher, who is also at the head of a hospital, on whom students wait for their instruction, and young doctors for their orders, is almost unique in civil life. The college president or the great merchant is less of an autocrat in his own field. The colonel of a regiment or the captain of a man-of-war alone surpasses him; and we must believe that Warren, with his temperament and opportunities, developed to the full the possibilities of the situation.

He was a very able surgeon of the painstaking type. In those days all operations, even the most inconsiderable from our point of view, were serious matters. Without antiseptics, there was always a probability of serious inflammation following, and without ether there was always intolerable pain. So the knife was used sparingly and of dire necessity only, and he was thought the skillful surgeon who could avoid it longest. Warren prepared with the greatest care for each operation. He read up his authorities, he consulted his notes, he studied his case and he practiced on the dead subject. By such practice he became rarely facile, but he never presumed on his facility. His work on the living was done methodically and with minute pains, to avoid hæmorrhage or damage to structure. His work was thoroughly done and it was well done. In all the minutiæ of dressings, bandaging and apparatus he was a past master. He held that, so far as possible, wounds should be closed without stitches, and his dressings were works of art. Indeed, in such work he set the pace, and the rare beauty and method of bandaging and apparatus in Boston hospitals are conspicuous to this day.

In one respect, his admiring brother and biographer does him an injustice, for he tells of his brilliancy in diagnosis and how he would form his opinion at a glance. For the great majority of common lesions this was doubtless true, but it is hard to believe that a man of Warren's careful and accurate mind would give way to the temptation of what we call "snap diagnosis," especially in those ancient days, when instruments of precision were lacking and the science of pathology was just struggling into life. We have copious notes of his clinical remarks, made at the meetings of the Boston Society for Medical Improvement, and such remarks leave us with a feeling that he came to his conclusions only after careful thought and the exhaustive comparing of conditions.

About the time of the hospital's founding, Warren was at the height of his career. He had always been rather delicate in health, and it had been his constant care to guard a chronic dyspepsia, to have his body in condition and to keep the machine in good working order, as we say. Yet he was a very laborious man. It was his habit to rise early on winter mornings and breakfast by candle light; then he went out and made professional visits until one o'clock, when he dined, giving himself about ten minutes for that function; he saw patients until two, when he lay down for an hour's rest. In the latter half of the afternoon, he made further visits, supped at seven and spent his evenings until two o'clock in the morning, at his books and in writing. On hospital and lecture days his labors were still further prolonged. It was not an easy self indulgent life.

With all his care and method, Warren was not a timid operator. His amputations were bold and brilliant; he removed cataracts with great success; he taught and practiced the operation for strangulated hernia—the first surgeon in this country to do so, and against strong professional opinion here; he introduced the operation for aneurism according to Hunter's method. His excisions of bones for tumor, especially of the jaw, became famous and are classics—for are they not recorded in volumes of the "Boston Medical and Surgical Journal?" In 1837, when fifty nine years old, he published his *magnum opus*, "Surgical Observations on Tumors," a thick octavo with plates—a great collection of cases and remarks, interesting and instructive today. But all this gives only a very faint idea of his ceaseless literary activity. He was always writing; reports, memoirs, essays, lectures poured from his pen. It was a fluent pen, and had behind it a brain stored with keen thoughts and abundant information.

His extra professional interests were multitudinous. Few men have felt so constantly the burthen of their responsibilities to the community. He was like an officer on dress parade, or like a careful father in the presence of his young children—always punctilious about appearances. He felt it must not be said that a man of his eminence or importance ever yet set a bad example or appeared to disadvantage. So he was forward in good works and had a hand in whatever was going. He was dogmatic and final in his decisions and explicit with his advice. In matters surgical, his word was law for many years. It was not until his old age, and with

the advent upon the scene of another strong, young and aggressive man, that his power began to wane.

With his own advancing years, he also saw his son, J. Mason Warren beginning to gain the public confidence, and so he found time to devote himself more to work outside of his profession. He was always greatly interested in comparative anatomy and paleontology. He was able to secure, among other trophies, the most perfect skeleton of the mastodon which exists—the monster is still preserved in the old building on Chestnut Street which has been known for sixty years as the Warren Museum. All through his life he devoted himself, like Hunter and Cooper before him, to the collection of anatomical specimens. This collection, together with the treasures of the Medical Improvement Society, passed years ago to the Harvard Medical School and formed the nucleus of the fine "Warren Museum" of that institution. He became a convert to total abstinence in middle life, and was for many years president of the Boston Society for the Promotion of Temperance in the use of alcohol. He was also president of the Natural History Society of Boston and was an active member of the Agricultural Society. An interesting organization for the promotion of scientific and literary pursuits, was founded by him; it included in its membership many of the most eminent and scholarly men of Boston and was at first known as the "Warren Club." Under the name of "The Thursday Evening Club" it flourishes to this day, with a history of unbroken excellence and interest, and at the present writing is presided over by the grandson of its founder.

Warren's acquaintance with the profession in this country and in Europe was extensive. He was more given to travelling than was the wont of Bostonians of his day, and he made an extended trip to Europe, when in middle life; renewing old acquaintance, seeing society—indeed he was present in London with his family at the time of Queen Victoria's coronation—and visiting the homes of science at the fountain head.

He was prominent in the establishment of the American Medical Association, of which the primary purpose was the elevation of medicine in practice and in teaching, and he was one of its early presidents. Of all these things we have the story admirably told by himself in his published biography.

Then there was that other great event with which his name is most conspicuously connected; the first public use in surgery of ether anæsthesia. That was in October, 1846, when he was approaching his seventieth year; an age which we are not wont to associate with great and daring progress in affairs. It is needless here to enter upon that most interesting and confused chapter of American surgery. Suffice it to admit as Jacob Bigelow admitted years afterwards, that to Warren belongs the credit, in his old age, of allowing his name and position to stand sponsor for this courageous and revolutionary experiment. Warren himself was too near the end of his career to benefit greatly by anæsthesia in surgery; but in some measure he saw its significance, and wrote about it and championed its uses always.

The old man lived on until 1856. Fifteen years before his death his wife died, leaving him with six grown children, and two years later he married a daughter of Governor Thomas Lindall Winthrop, who also died before him.

He kept busy almost to the end of his life, especially with his writing. His last surgical paper was published in May, 1855, just a year before his death, which closed a brief and painful illness.

His real work had been done long since, however. It is not a life which lends itself readily to eulogy. It was not full of striking events and dramatic incidents. Except for the ether business no event stands out conspicuously; and in that he but lent his name, as, indeed, but for him some other might have done. But it was his long and useful career that made him eminent; his services in helping to found a great hospital, his establishment of sound surgical methods, his correct and methodical teaching, his faithful searching out of the truth, his insistence upon drill, his contempt for the brilliant superficial. All these things were very important, and among us helped to set a new standard, up to which we have been growing ever since. He was indeed a man whose work our community could ill have spared; and though he was succeeded by the meteoric Henry J. Bigelow, the younger man would have found for his endeavors a very different field, had it not been so carefully and faithfully tilled through toilsome years by Warren.

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THE ETIOLOGY OF SEROFIBRINOUS PLEURISY WITH REFERENCE TO CYTOLOGICAL DIAGNOSIS.

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(From the Medical Clinic of Professor Osler.)

The etiology of the so-called "idiopathic" pleurisy with effusion in apparently healthy individuals has been a vexed question for over a half century. With the growth of our knowledge of bacteria as causal agents in disease, the early explanation that the inflammation was due to cold has seemed inadequate, and an attempt has been made to place the disease in the category of acute infections. From early suggestions by Pidoux, Bernutz, and Villemin the idea that many of the cases were of tuberculous origin has steadily gained ground in France, until in 1884 we find Landouzy taking the extreme position that "98 fois sur 100 les epanchements pleuraux; les pleuresies pretendues a frigore sont fonction de tuberculose apparent ou cachee" and to this view his countrymen seem to subscribe. For the Anglo-Saxon mind, however, it has seemed difficult to recognize the possibility of a tuberculous origin in an effusion coming on after mere exposure to cold, in an apparently otherwise sound, healthy, robust man, even more difficult than to realize that a small hemoptysis in a similarly apparently healthy person is a sign of tuberculous infection. As a result the French view has met with much opposition in England and in this country, the general view of the opposition being perhaps well expressed in the words of Prudden, who says in summarizing his investigations of effusions that "results seem to justify belief in the comparatively frequent occurrence of simple exudative pleurisy with serofibrinous exudate which is not tuberculous and not demonstrably associated with bacteria of any kind." Those who have chosen the middle ground have found that it slopes toward the Landouzy view and allows of but little lingering by the way.

The question, then, of the etiology of these pleurisies *a frigore* cannot be said to be absolutely settled. It has been attacked from almost every possible side; the method varying somewhat with the prevailing fashion in medicine at the time, but has proved a question that does not lend itself to easy solution. There is no *a priori* reason why the pleura should not be the seat of primary tuberculous infection. Indeed, when one notes at post mortem how carbon pigment and other foreign particles are apparently hurried by the lymphatic stream of the lung toward the pleura, there often to be lodged in the subpleural connective tissue, it would seem as if primary pleural might be even more frequent than primary pulmonary tuberculosis. The opportunity of directly determining the condition of the pleura in the acute stage of an uncomplicated pleurisy at post-mortem examination is rarely obtained, as a fatality at this period of the disease is an extremely infrequent event. These rare opportunities become of value statistically only if they fall into the hands of pathologists who perform the necropsy with the possibility of tubercles being present, well in mind. Medical literature seems peculiarly free from reports of such cases. The most satisfactory and at the same time the most startling statistics are those of Kelsch and Vaillard, who in sixteen fatal cases of acute pleurisy found tubercles on the pleura of sixteen. Of these sixteen cases, seven were serofibrinous, two hemorrhagic, four were first serous becoming purulent before death, and three were purulent when first seen. Of 147 cases of pleurisy in post-mortem cases, collected from literature by them, they found mention of pleural tuberculosis in 113, in 9 tuberculosis of other organs is mentioned, but no reference made to the condition of the pleuræ, and in only 25 is examination of the pleura for tuberculosis mentioned as negative. Few of these cases, however, fell in the category of acute uncomplicated pleurisies. Osler in analyzing the Johns Hopkins Hospital post-mortem records for his Shattuck Lecture in 1893, found of 101 cases 32 per cent were tuberculous; but of these eight were purulent and associated with pneumothorax, eleven were associated with general acute miliary tuberculosis, and thirteen only were of the chronic serofibrinous form. This last group only might be considered as belonging to the primary pleural affections. Barr reports definite tuberculous findings in the pleura of three cases of acute pleurisy dying within a few months from the onset of the disease, the earliest three months after onset.

Failing in the matter of large statistics on the direct post-mortem determination of the cause of the disease, there are open two avenues of investigation: the rather direct method of the examination of the exudate, and the indirect method of following the subsequent history of the patient. Along the latter line we have several carefully compiled sets of statistics, which show in general that pleurisy patients are very apt in short time from the onset of their disease to show signs of tuberculosis in other organs. Thus Fiedler reports that of 112 cases at the end of 2 years from the onset of the pleurisy only 21 were well. Of the others, 17 had died of tuberculosis while in the hospital, 8 had died shortly after leaving the hospital, and 66 gave definite signs of tuberculosis. Barr, in 74 cases, finds that 32 died within five years from the onset of the original disease, their aver-

age length of life being two and a half years. Of these 32, 21 died of tuberculous infections; seventeen of the cases could not be traced. Lemoine reports an apparent cure in but five of twenty-eight cases; of the others, one had tuberculosis at the time of his pleurisy, seven showed doubtful signs, and fifteen became definitely tuberculous later. Ricochon reports that of twenty-one cases, only ten were alive after a lapse of three years and they were all tuberculous. Bowditch reports in 1889 that of thirty patients who had acute pleurisy in the decade 1849-59, thirteen had died of phthisis; of nineteen in the decade 1859-69, nine had died; and of forty-one in the decade of 1869-79, ten had died; giving an average of 38 per cent of the 90 cases that subsequently died of tuberculosis. These cases are classed together without reference to the nature of the original disease, that is as to whether it was a "dry" pleurisy or pleurisy with effusion. Cabot's series of 152 cases, recently published, shows a decidedly smaller number of patients who became tuberculous subsequent to their pleurisy. Within five years but ten were affected, in the next five years eight more; in the next five years four more; and in the sixteenth year one more—a total of twenty-three, or 15 per cent. Twenty-one patients were living and sound between fifteen and twenty years after their attack; twenty-three between ten and fifteen years; and thirty-six between five and ten years, giving a total of eighty patients well five years or more after their pleurisy. Thirty-seven were alive within the first five years after the attack and fourteen had died of some illness entirely unconnected with pleural disease. Ninety per cent of the cases were well two years after the pleurisy.

While these statistics all point in one direction, they are in a sense not entirely satisfactory. One might take the ground that the original pleurisy, of whatever etiology, had, by its sequelæ of adhesions, thickened pleura, contracted chest, atelectatic portions of lung, etc., merely left the lung in a more receptive condition for infection by the omnipresent tubercle bacillus. On the other hand, when one sees post mortem how many healed foci of tuberculosis in the lungs may be demonstrated by careful search, he is not convinced that the thirty to sixty per cent of pleurisy cases that do not subsequently develop tuberculosis have not been able to withstand and take care of what was originally a tuberculous affection.

The aspirated exudate in pleurisies has been repeatedly studied bacteriologically by cover-slip, culture, animal inoculation, and serum reaction, and quite recently cytological examination has come into prominence. The cover-slip and cultural examinations give results that are capable of several interpretations. They led to the early recognition of what may be termed the bacteriological law of effusions, that bacteria are easily demonstrable in purulent but not in serous effusions, or conversely, effusions in which bacteria are easily demonstrable on cover-slip and in culture are purulent or tend to become so. Thus the large group of serous effusions has come to be regarded as sterile effusions. In these large effusions careful and tedious examination of sediment obtained by centrifugalizing relatively large quantities of fluid generally proves unavailing. If in some, cocci or other of the ordinary pyogenic group are found in cover-slip, they are generally not demonstrable in culture, an evidence of the bactericidal effect of the serum. The tubercle bacillus is almost never found on cover-slip in these serous effusions (though usually quite easily demonstrable in cases of pyothorax and pyopneumothorax secondary to pulmonary tuberculosis, and probably there to be considered as derived from some communicating pulmonary cavity). We find unanimous agreement on this point among all who have investigated effusions, among whom may be cited Ehrlich, Fraenkel, Wolff, Netter, Prudden, Osler, Dejerine, Renvers.

This group of sterile effusions then has been held by some to indicate that the whole process is a sterile process, leading to conclusions regarding "idiopathic" pleurisies similar to that of Prudden quoted earlier. On the other hand, in the French school, it is held to indicate that they are tuberculous in origin, the failure to find the bacilli being due in part to the fact that the bacilli are not easily dislodged from the pleura, perhaps due to the false membrane formed; and in part that if dislodged they are so few in number that in an effusion of one or two liters they offer "a needle in the haystack" problem as far as cover-slip preparations are concerned.

Tubercle bacilli may, however, be demonstrated in many of these effusions by the method of animal inoculation, and this method emphasizes the point last mentioned, as success is only to be obtained by inoculating relatively large amounts of the fluid. The method was first employed in 1884 by Chauffard and Gombault, who in twenty cases got ten deaths of animals from tuberculosis. Netter in twenty cases found eight positive; Widal and Ravaut, five out of seven; Eichhorst fifteen out of 23 or 65.2 per cent of cases; Le Damany forty-seven positive cases in fifty-five. Of the eight negative results four were clinically tuberculous. These results need no comment.

Some effort has been made to obtain agglutination of tubercle bacilli by the serum in effusions, but as yet the method has not proved of easy application or of much practical value. Debove and Renault have, however, obtained the tuberculin febrile reaction in tuberculous patients by injecting subcutaneously filtered pleural effusions; and conversely, Netter quotes statistics published by the Prussian government, in which Koch's tuberculin gave a positive reaction in thirteen out of fifteen patients suffering with pleural effusion. These statistics would seem to show that by careful laboratory work and by use of animals it is possible to prove the greater number of the so-called "sterile" effusions to be really tuberculous.

There has recently come in vogue a simpler method of examination by which it is hoped one will be able to differentiate this large primary group of cases with its bad prognosis from a much smaller group, probably usually due to a

small pneumonic patch, in which the exudate early may have contained a few of the pyogenic organisms which were soon killed through the bactericidal power of the exudate, cases which bear a much more hopeful prognosis. The method is that of the examination of the cellular content of the effusion, introduced by the work of Widal and Ravaut, published in 1900, and of Wolff published in 1901.

Widal and Ravaut divide effusions into three groups: the acute septic; the tuberculous (idiopathic), and the mechanical (cardiac and nephritic). The sediment of the first group, the septic cases, they find to be made up almost exclusively of polymorphonuclear cells, especially in streptococcus cases, with a few small mononuclears, a few endothelial cells, and red blood cells in cases due to the pneumococcus. Typhoid pleurisies tend to be hemorrhagic, but as to leucocytes, agree with the other septic cases. Of idiopathic pleurisies, they studied 56 cases, the effusion in all being taken as late as the ninth day from the onset of the disease or later. In these cases they find agreement in the fact that the white cells of the sediment are almost exclusively small mononuclear cells. In addition, are found many red-blood corpuscles, a few large mononuclear cells, a few large endothelial cells (apparently derived from the pleura), and only rarely a polymorphonuclear cell, except in two cases aspirated on the ninth day, in one of which there was about one polymorphonuclear cell to nine small mononuclears. They consider it of importance also that the endothelial cells are few in number and always isolated. Seventeen cases showed no endothelial cells. Animal inoculations were made in a number of these cases and at the time of their report, of seven of the experiment animals that had died, five showed tuberculous lesions. In the mechanical pleurisies, cells are fewer than in the two other groups. The characteristic cell is the endothelial cell from the pleura, and what they consider as pathognomonic are "placards" of two, three, or several endothelial cells without visible cell outlines.

Wolff's results agree in the main points with those of Widal and Ravaut. He, however, was successful in obtaining effusions from somewhat earlier cases, and added to the findings above given. He finds that very early in the disease the exudate in tuberculous cases is almost exclusively polymorphonuclear, and concludes that at first it is entirely so. The small mononuclear, however, soon becomes evident and at the third day may make up one-third of the cellular exudate, gradually increasing in proportion from then on until eventually the whole exudate may be made up of mononuclears. He concludes in general that the cellular method of diagnosis is more exact than the cultural, and that an exudate of one-half or more of small mononuclear cells speaks for the tuberculous nature of the process.

Gulland, without giving the details of his work, reports that his examination of exudates extending over several years, confirms the work just quoted. Although he has not had any cases as early as the third day, in his earlier cases he finds a minor percentage of polymorphonuclears. Among others, Barjon and Cade, Dopter and Tanton, and Courmont and Arloing have published confirmatory results. This method has been applied to other effusions and collections of pus in the body with somewhat similar results. Tuffier and Milian have found small mononuclear cells predominating in tuberculous peritonitis and hydrocele of tuberculous origin; Achard and Loeper in peritonitis, pleurisy, meningitis, and joint tuberculosis. Tissot claims that the pus of tuberculous abscesses contains a higher percentage of small mononuclears than that of those due to the common pyogenic bacteria, while Milian determines the same for the pyuria and hæmaturia of renal tuberculosis. Widal, Sicard, and Ravaut have shown the same for the meninges. These with other similar findings have led to the cytological doctrine that the small mononuclear leucocyte is the surest index to tuberculosis.

During the winter of 1901-02 a number of pleural exudations, in particular those from "idiopathic" pleurisies in patients in the service of Dr. Osler at Johns Hopkins Hospital, were studied as to their cellular content. While this number was not large enough to entitle one to draw any sweeping conclusions, yet the results obtained would seem to point to the fact that the cellular constitution of an exudate may be of some diagnostic value. My results are in general confirmatory of those already published. In the primary pleurisies the exudates were usually of large volume and of fairly high specific gravity, the limits being 1.014 and 1.022 with an average of about 1.018. They were about evenly divided between a slightly turbid greenish-yellow fluid and one with a decided blood tinge. The albumen content was high and the reaction slightly alkaline to litmus but never to phenolphthalin. Cellular sediment was abundant. I find there is a very definite formula to the cellular exudate; and that the time at which the exudate is taken is a marked factor in determining the particular proportion of cells. My earliest cases were taken at about the end of the first week if I may except one case, a colored boy whose history as given is doubtful. In these cases, three in number, the polymorphonuclears form from 15 to 12 per cent of the exudate, the other cells being almost entirely small mononuclears, with a few cells indistinguishable from the large mononuclears of the circulation. During the second week, as shown in four cases, there is a fall in the number of polymorphonuclears (relatively and probably absolutely also), the limits being from 5 to 3 per cent. After this time, according to six cases studied, it is often impossible to find a single polymorphonuclear on a slide, the exudate being almost entirely mononuclear. There is always to be found a fairly large number of red-blood corpuscles and a few scattered and isolated epithelial cells.

Two cases on the seventh day formed an exception to this rule, showing an exudate composed of almost equal numbers of polymorphonuclears and small mononuclears. One of these effusions was a terminal event in a chronic cardiac case who gave a history of onset with pain in the side, cough, and bloody sputum. The exudate was markedly hemorrhagic. While this cellular formula comes within Wolff's

tuberculous limit, it also agrees almost exactly with the formula Barjon and Cade have found in effusions associated with infarct of the lung, which seems a probability in this case. Unfortunately no post mortem was obtained.

The other case was in a man, who a week before admission had, after exposure, been taken with a chill, pain in the side, and cough, followed in a couple of days by bloody sputum. At the time of admission he had no fever and no pulmonary signs except the flatness due to the effusion. The effusion was small in amount and showed forty-five polymorphonuclears to fifty-five small mononuclears, while almost a half of the sediment was made up of large epithelioid cells. There seemed a probability in this case also that the exudate was secondary to some slight pulmonary involvement.

A third exception was the exudate in the colored boy which on the third day, unless his history was misleading, which seems probable, showed 100 per cent small mononuclears.

In none of the exudates was the tubercle bacillus obtained on cover-slips. Cultures were made from a fair proportion and were uniformly negative.

In two cases of pyopneumothorax, secondary to tuberculosis of the lung, the exudate showed a large percentage of polymorphonuclear cells, probably over 80 per cent, although it was difficult to determine this exactly because of the marked disintegration of the cells. In both, the tubercle bacillus was found in cover-slip. In a single case of metapneumonic exudate, in which the pneumococcus was demonstrated on cover-slip, the exudate consisted of about 96 per cent of polymorphonuclears to 4 per cent of small mononuclears. The exudate was purulent. In three mechanical exudates or transudates the specific gravity of the fluid varied between 1.005 and 1.015. The cellular sediment was much smaller in amount. Epithelioid cells formed quite a large percentage, existing singly and in the "placards" which Widal and Ravaut consider so pathognomonic. The other cells were mononuclears 96 to 99 per cent, and polymorphonuclears 4 to 1 per cent, with a relatively large number of red-blood corpuscles. Thus, except for the more numerous epithelioid cells and the "placards" a slide made from a hydrothorax sediment would be very difficult to diagnose from a slide made from the sediment of an "idiopathic" pleurisy. This is a diagnosis, however, for which one would seldom be obliged to resort to the microscope. Widal and Ravaut explain the "placards" as indicating a transudate and not an exudate; the slow mechanical filtration of serum through the pleura causing a loosening of the epithelium which falls off or is rubbed off by respiratory movements. The absence of "placards" in inflammatory cases Ravaut attributes to the formation of a false membrane on the pleural surface preventing marked desquamation or holding the desquamated cells in its meshwork of fibrin.

Wolff in his first paper was inclined to consider the pleuritic effusion a transudate and not an exudate chiefly because of the supposed nonmotility of the lymphocyte. Following the demonstration by Hirschfeld of the motility of the lymphocyte and his own work on the same subject, he has reconsidered his view. Another factor leading to his change of view was that in a transudate one would expect red cells and lymphocytes leaving the vessels passively to occur in the effusion in about the same proportion as in the circulating blood, whereas one finds them in the pleural effusion in an entirely different proportion, the lymphocyte often predominating. Throughout, he assumes that the small mononuclear cell is the lymphocyte of the circulating blood, in which he would seem to be justified from its occurrence in the exudate in intimate association with other elements clearly hæmatogenous. Pappenheim, in a foot-note to a paper on the plasma cell, seems to take the view that the cell is derived from the subpleural connective-tissue cells. Patella is convinced that the cell is not a lymphocyte or small round cell, but is derived from pyknotic nuclear fragments of the pleural epithelial cells, an opinion in which he seems to stand alone. The question of the nature of the small mononuclear in the exudate is one with that of the nature of the small mononuclear infiltrating the periphery of the tubercle and tissues generally, a discussion of which cannot be entered into here. Nor may I discuss from this work the question of whether the presence of the lymphocyte in the effusion shows a positive chemotaxis, due to the tubercle bacillus, or whether it shows merely that the exudate is tending to chronicity. Ribbert stands for the view that the lymphocyte speaks for chronicity in an exudate. Some of the recent work with experimental sterile pleural exudates produced by aleuronat injections, notably that of Sweet, seems to show that there is a tendency for the proportion of mononuclears in the exudate to increase rapidly rising from 10 per cent in the first 24 hours to 50 per cent approximately in the third and fourth days. The subject is one that needs further work.

From this study of the pleurisy cases I do not pretend to show that all idiopathic pleurisies are tuberculous. That, I believe, can only be shown by a large series of animal inoculations. What this study has shown, however, is that they have an exudate remarkably uniform in cellular content and general characters, which may be assumed to indicate a uniformity in the nature and etiology of the process. This uniform cellular formula, the work of others seems to indicate, is the formula of tuberculous pleurisy.

Clinically considered, the cases of primary pleurisy studied may be divided into two groups:

First. The largest group includes those which may be termed insidious pleuritis. These cases, though giving a history of a more or less acute onset with cough or pain in the side have had so little fever and so few general symptoms that they have kept about until the volume of the exudate has caused marked dyspnœa. The exudate in this group is practically a chronic one, when aspiration is made.

Second. A smaller group including the cases in which the attack sets in with so marked a fever and such severe general symptoms that the patient is forced to take to his

bed at onset. This group consisted of three cases in this series. The fever ran a course resembling that of typhoid fever, and became normal only after the third week. In one case, which for some time was regarded as typhoid, the Gruber-Widal reaction was tried with the blood serum and the exudate, but was negative in both cases, as were also cultures from the same sources.

The cellular formula shows no distinction between these groups of cases, cases from both groups following the general formula as given above. The aspiration of the exudate seemed to have no effect on the course of the fever in either group.

A possible predisposing factor in these cases, beyond the usual one given of exposure to cold or damp weather, would seem to be indicated by the blood count. The red-blood count was uniformly high, often quite a little above 5,000,000 corpuscles per cubic millimeter, while the hæmoglobin determination was as uniformly in the neighborhood of 70 per cent, thus giving a color index of a little less than 0.7. But a single case of the series has come to autopsy, and that a colored man who had a left-sided pleurisy with effusion in 1900 and a right-sided effusion in the fall of 1901 without tubercle bacilli being demonstrable in the sputum at either admission or without intrapulmonary signs. At the post mortem in November, 1902, almost complete obliteration of both pleural cavities was found and also marked tuberculous involvement of the lungs.

Summary of Cases.

I. Hospital No. 37,206. Male; white; age 32. Onset after exposure with pain in left side followed by high fever and cough. Fever high and continuous, reaching normal only on 25th day. Aspiration of left pleura on 15th day of disease, 1700 cc. of clear straw-colored neutral fluid. Specific gravity, 1.017, culturally negative. Cellular content shows practically no endothelial cells; a few red-blood cells. Polymorphonuclears, 5 per cent; mononuclears, 95 per cent. Blood count, Hb., 78 per cent; R. B. C., 4,200,000; W. B. C., 10,000.

II. No. 38,067. Male; white; age 43. Onset after exposure with pain in left side followed by cough and sharp fever. Fever continuously high, reaching normal on 27th day. Aspiration on 13th day, 200 cc. of clear fluid, Sp. gravity, 1.019, culturally negative. Polymorphonuclears, 1 per cent; small mononuclears, 99 per cent; a few red cells present. Sputum negative to examination for tubercle bacilli. Blood count, Hb. 78 per cent; R. B. C., 5,032,000; W. B. C., 4800.

III. No. 38,700. Male; colored; age 38. Cough for a week, followed by pain in right side, dyspnœa and fever. Fever ranging between 102 and 103 degrees F., slowly declining to normal on 23rd day. Aspiration on 7th day, 600 cc. slightly bloody fluid, neutral, 1.008. Contains polymorphonuclears, 14 per cent; small mononuclears, 86 per cent; many red-blood corpuscles and few endothelial cells, culturally negative; no tubercle bacilli in sputum. Blood count, Hb. 70 per cent; R. B. C., 5,632,000; W. B. C., 8000.

IV. No. 36,393. Male; white; age 25. Onset with pain in right side, dyspnœa, cough. Moderate fever, remittent in type. Aspiration on 7th day, 1140 cc. slightly turbid fluid, alkaline 1.019, culturally negative. Cellular content; polymorphonuclears, 12.2 per cent; small mononuclears, 84.8 per cent; large mononuclears, 3 per cent. Blood count, Hb. 65 per cent; R. B. C., 4,800,000; W. B. C., 5300.

V. No. 37,252. Male; white; age 35. Onset with pain in left side followed by cough. Fever remittent early, later intermittent. Aspiration on 7th day, 1250 cc. slightly blood-stained fluid, alkaline to litmus, 1.014. Cellular content; polymorphonuclears, 15.1 per cent; small mononuclears, 81.1 per cent; large mononuclears, 3.8 per cent. Three endothelial cells seen in counting 500 cells. Several degenerated nuclear masses; red-blood corpuscles numerous. No tubercle bacilli found in sputum. Blood count, Hb. 75 per cent; W. B. C., 75 per cent.

VI. No. 37,242. Male; white; age 67. Patient suffering from carcinoma of the stomach and marked anæmia. Pain in left side after exposure, followed by dyspnœa. Fever intermittent in character. Aspirated 12th day, 240 cc. slightly blood-stained fluid, alkaline, 1.015. Cellular content; polymorphonuclears, 5.1 per cent; small mononuclears, 91.7 per cent; large mononuclears, 3.2 per cent. Eleven endothelial cells seen in counting 500 cells. Nuclear fragments and red-blood cells numerous. Cultures negative. Blood count, Hb. 50 per cent; R. B. C., 3,576,000; W. B. C., 7000.

VII. No. 36,973. Female; colored; age 10. Onset with cough, followed by dyspnœa. Fever irregular. Aspiration on 15th day, right side, 1200 cc. slightly turbid fluid. Cellular content; polymorphonuclears, 5 per cent; small mononuclears, 95 per cent. No endothelial cells found. Many red-blood cells and nuclear masses. Blood count, Hb. 65 per cent; R. B. C., 4,668,000; W. B. C., 8375.

VIII. No. 38,563. Male; white; age 25. Onset with pain in left side; shaking chill and fever, with cough. Fever slight, irregular. Aspirated on 13th day 500 cc. clear fluid, 1.022. Cellular content; no polymorphonuclears seen on slide in counting 500 mononuclears. A few endothelial cells seen. Red-blood cells numerous. Blood count, Hb. 70 per cent; R. B. C., 6,048,000; W. B. C., 4200.

IX. No. 36,643. Male; colored; age 39. Pleurisy with effusion, left side, six months before, since which symptoms suggestive of pulmonary involvement. Date of onset of right-sided pleurisy indefinite; duration probably some weeks. Fever moderate, intermittent. Aspiration, right side, 375 cc. slightly blood-stained fluid. Cellular content; polymorphonuclears, 3 per cent; small mononuclears, 97 per cent; many red-blood corpuscles. No tubercle bacilli found in sputum. No definite pulmonary signs. Blood count, Hb. 72 per cent; R. B. C., 5,760,000; W. B. C., 11,000. Death November, 1902, one year after pleurisy on right side. At post mortem both pleural cavities obliterated; adhesive pericarditis and tuberculosis in both lungs found.

X. No. 38,141. Male; white; age 21. Onset with pain in right side six weeks before admission. Cough and dyspnœa main symptoms. Fever moderate, intermittent. Aspirated, right side, 980 cc. clear greenish-yellow fluid, 1.021. Ten days later aspirated 1050 cc. clear fluid, 1.019. Cellular content; polymorphonuclears, 2 per cent; mononuclears, 98 per cent, of which small mononuclears are 90 per cent and large mononuclears 10 per cent. A few endothelial cells and red-blood cells found. Blood count, Hb. 70 per cent; R. B. C., 5,736,000; W. B. C., 5100.

XI. No. 38,486. Male; colored; age 43. Onset with pain in back, with some dyspnœa; no other symptoms. Fever intermittent. Fluid examined taken from fourth aspiration of left side on 16th day, 1600 cc. removed, slightly turbid fluid, 1.016. Cellular examination shows a few red-blood cells and endothelial cells. Otherwise sediment is made up entirely of small mononuclears; no polymorphonuclears found on slides. Sputum examination for tubercle bacilli negative. Blood count, Hb. 78 per cent; R. B. C., 4,352,000; W. B. C., 5400.

XII. No. 38,091. Male; colored; age 17. Onset with pain in left side, symptoms few and slight. Fever remittent, showing

rather sharp evening rise. Aspirated left side in third week of disease, 400 cc. slightly turbid fluid, 1.019, neutral. Cellular content slight; red cells few in number. Other cells; entirely small mononuclears. Sputum negative for tubercle bacilli. Blood count, Hb., 58 per cent; R. B. C., 4,784,000; W. B. C., 5250.

XIII. No. 39,039. Male; white; age 9. Onset with cough. Symptoms few. Fever very slight, irregular. Patient aspirated before admission to hospital. Second aspiration some weeks after onset of disease, 30 cc. clear fluid obtained. Fluid shows no polymorphonuclears; red-blood cells plentiful. Sediment made up almost entirely of small and large mononuclears in proportion of 2 to 1. Blood count, Hb. 70 per cent; R. B. C., 4,784,000; W. B. C., 4400.

XIV. No. 38,918. Male; white; age 17. Onset insidious. Patient entered hospital with signs of involvement of lungs, pleuræ, pericardium, and peritoneum. Fever moderate, irregular. Aspiration of left pleura some weeks after onset gave one liter of brownish-red turbid fluid, 1.017. Sediment made up entirely of mononuclears and red-blood corpuscles. Tubercle bacilli found in sputum ten days after aspiration. Blood count, Hb. 68 per cent; R. B. C., 4,492,000; W. B. C., 10,000.

XV. No. 38,614. Male; colored; age 10. Cough week before admission. Chill three days before; otherwise no marked symptoms. Fever remittent with sharp evening rise. Right side aspirated three days after chill, 500 cc. blood-stained fluid, 1.018, neutral, culturally negative. Sediment shows many red cells, few white cells, entirely of mononuclear variety. Blood count, Hb. 71 per cent; R. B. C., 5,492,000; W. B. C., 5330.

XVI. No. 37,858. Female; white; age 58. Cardiac case. Onset with cough, pain in right side and bloody expectoration; dyspnœa and sharp rise in temperature. Aspiration on 8th day, 600 cc. dark blood-stained fluid, 1.017, neutral reaction. Sediment shows many red-blood cells; of the white cells polymorphonuclears are 46 per cent, with small mononuclears 54 per cent. Cells somewhat disintegrated and differentiated with some difficulty. Patient died on following day. No post mortem obtained.

XVII. No. 37,370. Male; white; age 37. Onset with chill and pain in right side after exposure. Sputum slightly blood tinged. Practically no fever. Leucocytes, 9500. Aspiration on 8th day, 260 cc. clear fluid obtained, 1.018, alkaline. Cellular content; large endothelial cells form almost a half of the exudate. Polymorphonuclears, 55 per cent; small mononuclears, 45 per cent; many red-blood cells. No tubercle bacilli in sputum.

XVIII. No. 36,679. Male; white; age 25. Pulmonary tuberculosis recognized March, 1901, when tubercle bacilli were found in sputum. Onset of pleurisy insidious; dyspnœa only symptom. Right side aspirated five times in October and November, 1901, with development of pneumothorax after second aspiration. Cellular content of exudate noted as chiefly polymorphonuclear. Patient returned in March, 1902. Pneumothorax still present. Liter of greenish-yellow seropurulent fluid removed, faintly alkaline, 1.021. Cells somewhat disintegrated. Polymorphonuclears apparently 84 per cent; small mononuclears, 16 per cent. Endothelial cells not infrequent. Tubercle bacilli found in exudate.

XIX. No. 37,138. Male; colored; age 20. Tuberculous symptoms for nine months; pain in right side for two months; definite signs of pneumothorax with fluid. Aspiration, right side, gave 1300 cc. greenish seropurulent fluid, faintly alkaline, 1.025; containing heavy sediment of rather disintegrated cells. Differential count impossible, but polymorphonuclears appear in great majority. Tubercle bacilli found in exudate.

XX. No. 37,037. Male; colored; age 40. Mitral insufficiency with right-sided hydrothorax. Aspiration, 1200 cc. slightly blood-stained fluid, 1.013, slightly alkaline. Cellular content; polymorphonuclears, 1 per cent; large mononuclears, 9 per cent; small mononuclears, 90 per cent. Many endothelial cells and a number of "placards" of three and four cells. Death; post mortem showed no pleurisy.

XXI. No. 36,522. Male; white; age 60. Cardiac, with bilateral hydrothorax. Repeated aspiration of both sides, October 10, 600 cc. from left chest, slightly blood-stained fluid, 1.012. Cellular content; many red-blood cells and small mononuclears. No polymorphonuclears found. Endothelial cells and "placards" numerous. November 4, aspiration right side, with similar fluid and similar cellular content.

XXII. No. 38,362. Female; white; age 17. Chronic nephritis following scarlet fever. Marked œdema, ascites, hydrothorax. March 26, chyloid fluid removed by aspiration from abdominal cavity, 1.010; March 27, left pleura aspirated and 800 cc. of watery fluid with very slight milky tint removed; Sp. gravity, 1.005. Cells form but slight sediment on centrifugalization. A few endothelial cells found and a few "placards," some of four and five cells. Of other cells, small mononuclears form 96 per cent; polymorphonuclears, 4 per cent.

XXIII. No. 37,413. Male; white; age 21. Lobar pneumonia, followed by empyema of left pleural cavity. Exudate showed cells much disintegrated, and almost entirely polymorphonuclears, yet some perfectly preserved small mononuclears found in the proportion of about 4 per cent. The micrococcus lanceolatus was found on cover-slip.

In conclusion I wish to express my thanks to Dr. Osler and Dr. McCrae for their interest in the work, and to my fellow house officers of the medical staff for their kind co-operation.

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A CASE OF PEPTIC ULCER IN THE JEJUNUM OF A DOG FOLLOWING GASTRO-ENTEROSTOMY, WITH A REVIEW OF THE CASES REPORTED IN MAN.[1]

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During the past winter, while Dr. Sowers and I were conducting some experiments upon animals, we had occasion to do a gastro-enterostomy in a dog.

The anterior, or rather the ventral, operation was done. A loop of jejunum, at a distance of about thirty centimeters from the pyloric orifice, was sutured to the ventral surface of the stomach near its greater curvature, care being taken to have the peristaltic movements of the jejunum and stomach correspond in direction.

No mechanical appliance was employed, but after suturing the peritoneal surface of the intestine to that of the stomach by a posterior continuous suture of fine silk, corresponding incisions were made into stomach and intestine, and the cut edges then sutured together around the entire opening by means of a continuous suture of the same material passing through all the coats of each. The anastomosis was completed by a row of mattress sutures around the anterior border of the opening. The posterior continuous suture extended several centimeters beyond either end of the anastomotic opening to prevent spur formation in the intestine.

The animal recovered rapidly and seemed quite well until three months after the operation, when he became sick, refused food, and soon died. At the autopsy death was found to be due to general peritonitis resulting from a perforation of the jejunum near its attachment to the stomach.

On opening the intestine two ulcers were found almost directly opposite to the opening into the stomach. They were in that portion of the intestine distal to the opening, namely, that which would receive the stomach contents and were in no way connected with the line of suture, though the silk suture in places projected through the mucosa and would seem to form a *locus resistentiae minoris*.

The edges of the ulcers were fairly sharply cut and there was little inflammatory reaction about them. In one the process had extended down to the muscular coats of the intestine and in one place to the serosa. The other had perforated and caused death as mentioned above.

[1] Read before the Johns Hopkins Hospital Medical Society, June 1, 1903.

The accompanying drawing of the alcoholic specimen will explain itself.

I had the pleasure of showing my specimen to Prof. Mikulicz on his recent visit to Baltimore. He said it was the first instance of the production of such ulcers in animals. I have been able to find no similar case reported.

Since Braun in 1899 first described the formation of peptic ulcer in the jejunum of man, the subject has received considerable attention among German surgeons, but I have been able to find no cases in the English literature.

Cases have been reported by Braun, Hahn, Kausch, Körte, Kocher and others. Altogether I have been able to find fourteen cases reported. This number does not include Hadra's case. See foot note.

Remarks.

The occurrence of such ulcers in the jejunum after gastro-enterostomy brings up several interesting points for consideration: namely, their frequency, the symptoms produced by them, the factors concerned in their formation, and the influence of their occurrence upon the choice of operation.

I. Their frequency.—The only statistics I have been able to find are those of Kausch, who in 1900 reported two cases among 160 gastro-enterostomies in the service of Prof. Mikulicz. They are probably of more frequent occurrence than these figures would indicate.

II. Symptoms produced by them.—The symptoms of jejunal ulcer are very similar to those of peptic ulcer of the stomach. The burning pain in the epigastrium is usually severe. It is temporarily relieved by taking food but returns with greater severity in an hour or two. Vomiting occurs frequently. Perforation of the ulcer, in case the anterior operation is done, often leads to the formation of a localized abscess, which can be felt as a mass beneath the recti.

III. The factors concerned in their formation.—It seems conclusive that the main factor in their production is the hyperacid gastric juice, which is emptied directly into the jejunum.

In each of the fourteen cases, which I have been able to collect, the operation was performed either for gastric ulcer

or benign pyloric stenosis, with or without ulcer, and in ten of these there was an hyperacidity of the gastric juices. The giving of bicarbonate of soda after gastro-enterostomy for gastric ulcer has therefore been suggested.

Nevertheless, the very fact that in some of the reported cases the acidity was normal or decreased makes the existence of other determining factors necessary. Some of those which might be suggested are:

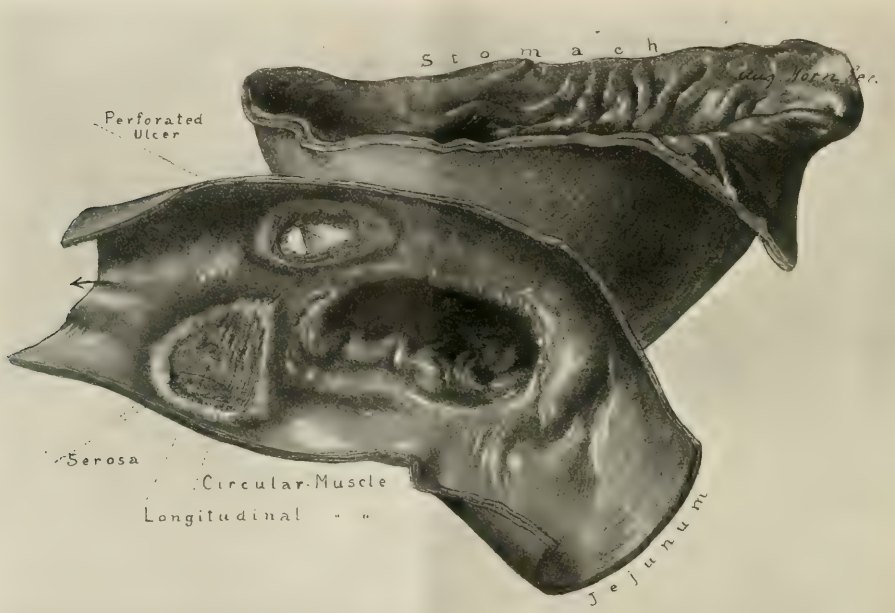
(1) An injury to the mucosa of the intestine by bread crumbs, pieces of bone, foreign bodies, etc. At autopsy I found in the dog's stomach several large stiff straws, which might readily have caused such an injury.

(2) Interference with the circulation of the bowel at the time of operation. Steinthal thinks this happened in his case, which died ten days after the operation; however, the fact that in all the other cases reported the symptoms of ulceration did not appear until much later (three months to three years), would probably rule out this factor.

(3) Traumatism to the abdomen must be considered. In one of Hahn's cases the ulcer followed a blow upon the abdomen. This may have been merely a coincidence.

(4) Kocher thinks the acid gastric juice may stimulate circular contraction of the jejunum just below the stomach with the formation of a kind of cul-de-sac, where the contact of the gastric juices with the intestinal mucosa may be prolonged and give rise to ulceration. He claims to have seen such contraction several times in cases of gastro-enterostomy which he explored.

IV. The influence of their occurrence upon the choice of operation.—The occurrence of these ulcers after gastro-enterostomy is an additional argument for pyloroplasty, rather than gastro-enterostomy in cases of benign stricture of the pylorus, where the former is feasible. The pyloroplastic operation recently devised by Dr. Finney seems applicable to most cases of benign stricture.



Although peptic ulcers do occur in the duodenum, one would naturally suppose its resistance to the action of the gastric juices greater than that of the jejunum; at least, no case of ulcer of the duodenum after pyloroplasty has been reported.

If pyloroplasty is not feasible and gastro-enterostomy is to be done, the question arises as to whether, from our point of view, the anterior or posterior operation is preferable. Of the fourteen cases of jejunal ulcer, which I have collected, the anterior operation had been done in ten, the posterior in two, and the Y operation of Roux in one. In the remaining case the character of the operation is not stated. This seems to indicate that they occur much more frequently

with the anterior operation, but we must remember that the anterior operation has been performed more frequently than the posterior.

If they occur equally often with either operation, then the anterior is to be preferred, for in these cases the jejunum very readily becomes adherent to the anterior abdominal wall, so that perforation of the ulcer often gives rise to localized abscess, rather than general peritonitis. A review of the reported cases proves this to be true. Of the ten cases, in which the anterior operation was done, in three perforation was followed by general peritonitis, and in seven by localized abscess. In both cases in which the posterior operation was done, perforation was followed by general peritonitis.

Kocher's case is the only one of those reported, in which the Y operation of Roux had been done. An ulcer was found in the jejunum just below its junction with the stomach. As Kocher himself remarks, one would very naturally think patients upon whom this operation had been performed especially liable to such ulcers for in them the gastric juice, as it passes into the jejunum, is not neutralized by the alkaline bile and pancreatic juice, which enter the intestine at a lower level.

The whole subject of peptic ulcer of the jejunum is an extremely interesting one and offers an inviting field for further experimental work. I hope to pursue the subject myself.

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Kausch: Ibid., Bd. xxviii, 1899, S. 74, Bd. xxix, 1900, S. 140, and Bd. xxxi, 1902, S. 115.
Körte: Ibid., Bd. xxix, 1900, S. 137.
Steinthal: Ibid., Bd. xxix, 1900, S. 139.
Hadra: Ibid., Bd. xxix, 1900, S. 152.
Neumann: Deutsche Zeitschrift für Chir., 1901.
Kocher: Die Verhandl. d. Deutsch. Gesellsch. f. Chir., Bd. xxxi, 1902, S. 103.
Heidenhain: Ibid., Bd. xxxi, 1902, S. 108.
Goepel: Ibid., Bd. xxxi, 1902, S. 108.

ANALYSIS OF REPORTED CASES.

Reference.	Operation, Anterior or Posterior.	Gastric Acidity.	Operation for.	Number of Cases.	Number of Ulcers.	Time after Operation.	Result.
Braun.	Posterior.	Normal.	Dilated stomach.	1	1	1 year.	Perforation; peritonitis; death.
Hahn.	All anterior.	All cases. +	Benign stenosis of pylorus.	3	....	....	1st case, perforation and death. 2d and 3d cases, abscess; operation; cure.
Kausch.	All anterior.	2 cases. + 1 case normal.	1st and 2d, pyloric stenosis. 3d, ulcer of stomach.	3	1st and 2d cases, 1 each. 3d case, ulcer recurred.	1st case, 4 months. 2d and 3d cases, ?	1st and 2d cases, perforation; abscess; operation; cure. 3d case, recurrence of ulcer; jejunostomy; death.
Körte.	Anterior.	+	Gastric ulcer.	1	1	3 years.	Perforation; peritonitis; death.
Steinthal.	Posterior.	+	Pyloric stenosis.	1	4	10 days.	Perforation; death.
Hadra.*	?	+	Pyloric stenosis.	1	1	6 months.	Perforation; abscess; operation; fistula.
Neumann.	Anterior.	+	Functional. Pyloric stenosis.	1	1	3–4 months.	Perforation; abscess; operation; cure.
Kocher.	Y of Roux.	—	Gastric ulcer.	1	1	12 months.	Perforation; abscess; operation; cure.
Heidenhain.	Anterior.	Normal.	Pyloric stenosis with ulcer.	1	1	3–4 months.	Perforation; adhesions; operation; cure.
Goepel.	Anterior.	Both. +	Pyloric stenosis. Gastric dilatation.	2	1 each.	4 months. 13 months.	1st case, perforation; death. 2d case, perforation; suture; cure.

*He is not certain whether ulcers were in stomach or jejunum.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

Volume XIII is now completed. The subscription price is $1.00 per year. The set of thirteen volumes will be sold for $32.00.

THE ADVANTAGES OF THE SIMS POSTURE IN CYSTOSCOPIC EXAMINATIONS.

By John A. Sampson, M. D.,
Resident Gynecologist, The Johns Hopkins Hospital.

A full account of the methods used in this hospital, for cystoscopy in women, may be found in Kelly's Operative Gynecology, published by D. Appleton & Co., New York, 1898.

The fundamental principles of a cystoscopic examination have been thus stated by him (see pp. 274 and 275, Vol. 1);

"1. The introduction of a simple cylindrical speculum into the bladder.

2. The atmospheric distention of the bladder induced solely by posture.

3. The illumination and inspection of the vesical mucosa, either by means of a direct light, such as a little electric lamp attached to the forehead or the mouth of the speculum, or by means of a strong light reflected by a head mirror.

The view of the bladder obtained in this way is a direct one; and the open speculum allows the operator to touch any part of the bladder with a sound, and to introduce various instruments with ease."

In regard to the posture of the patient, Dr. Kelly states, "Two postures are available, an elevated dorsal and a knee-breast. The dorsal position is the most convenient to use and the least tiring to the patient, but it is only of service in thin patients, and the atmospheric expansion is not so good; the bladder of a fat women will rarely distend at all in this posture." . . . . . "The knee-breast position is the one position most satisfactory and applicable in all cases."

The advantages of the above method over others where a closed cystoscope is used in the bladder distended with air or fluid are:

1. Various operations may be done through the open cystoscope; as, foreign bodies may be removed, small growths excised, ulcers curetted, etc.

2. Local applications may be made to portions of the bladder, as an ulcer may be treated with silver nitrate, etc., without touching the rest of the bladder.

3. Bloody or purulent urine does not obscure the field of vision as it would in a bladder filled with fluid.

4. The catheterization of the ureters is accomplished under more aseptic conditions when the catheter passes into the ureter through a bladder distended with air than when distended with fluid.

5. Knowledge of the condition of both kidneys may be obtained without catheterizing the ureters; namely, by catching the urine as it comes from the ureter, by pressing a cystoscope with a bevel edge around the ureteral orifice or by means of an instrument devised by Dr. Kelly for this purpose.

6. Also in a known unilateral infection, the diseased kidney may be catheterized and the bladder washed out, and the urine collecting in the bladder will be from the kidney not catheterized, while that from the diseased kidney will pass out of the renal catheter without entering the bladder. Thus we may obtain urine from the supposedly healthy kidney without the danger of catheterizing it in the presence of infection.

7. Bladders of patients with vesico-vaginal fistulæ may in many instances be satisfactorily examined.

8. The instruments used are simpler, less expensive and less likely to get out of order.

The disadvantages of this method are:

1. The knee-breast posture, the one most available and the one which has been used almost exclusively in this hospital, is difficult for a well woman to properly assume and maintain, and still more difficult or even impossible for an invalid or a patient just recovering from an operation.

2. In a very small percentage of the cases the bladder will not distend properly unless a general anesthetic is used.

3. The knee-breast posture is rather an embarrassing one, but on account of its advantages does not deserve the criticisms made by Morris, on p. 324, Vol. II, Surgical Disease of the Kidney and Ureter, Cassel & Co., London, 1901, who makes the following objections to ureteral catheterization:

"1. The obnoxious nature of the operation in the female and the extreme difficulty of it in the male.

2. The unreliableness of the information it affords.

3. The risks to which it exposes the patient.

4. The disadvantages of it as a mode of treatment."

He treats each of these objections separately, and under the first he states, "*The positions in which women are placed,* whether the elevated dorsal or the knee-pectoral, as shown by Howard Kelly's plates, are very revolting to the finer feminine sense, unless the patient is under an anesthetic, and suffice in some instances to make her refuse to submit to a second examination; and as the time required for catheterization of the ureter is often considerable, and when the operation is adopted as a means of treatment for ureteral stenosis or irrigation, it has to be repeated every few days, and sometimes over several months, general anesthesia is out of the question." I might also add that the other objections of Morris to ureteral catheterization are certainly not in accordance with our experience in this hospital.

On April 15, of this year, I wished to examine the bladder of a woman, who had a large post-operative vesico-vaginal fistula. The fistula had resulted from hysterectomy for cancer of the cervix of the uterus, where it had been necessary to resect a portion of the bladder wall in order to get well outside of the growth. The patient was very fleshy and weak, and I realized that she was unable to assume the knee-breast posture. The elevated dorsal, whether the elevation is accomplished by placing pads under the hips as described by Kelly, or by elevating the end of the table, as reported by Webster, Jour. Amer. Med. Ass., 1902, XXXVIII, 1299, did not appear to be applicable in this case. I consequently placed her in the Sims position with buttocks at the end of

the table and elevated slightly the end of the table. A No. 10 cystoscope was used and I found that the bladder dilated well. I could see all parts, both ureteral orifices, and found that the fistula which was oval, had a long diameter of 4 cm., and was situated for the most part posterior to the trigonum, both ureteral orifices being about 1 cm. lateral to the anterior portion of it. The fistula was closed through the vagina ten days later without either a local or a general anesthetic. The bladder was first dissected free and closed and then the vagina was sutured over it. The operation did not cause any pain. The previous operation, namely, the hysterectomy with removal of the upper one-fourth of the vagina, had apparently caused the loss of sensation of pain to the vagina and that portion of the bladder.

From April 15 until the present time, June 18, I have used the posture in 20 patients, and several of these patients had cystitis, requiring local applications, and were treated two to three times a week. I found that in these patients the exposure of the bladder was usually as good, and the ease in making local applications and catheterizing the ureters as great, as in the knee-breast posture. In several instances I examined the same patient in both postures and so was able to compare the two. Of these 20 cases, 5 had vesico-vaginal fistulæ, 6 cystitis, and in the rest the bladders were examined or the kidneys catheterized for diagnostic purposes.

In the cases with vesico-vaginal fistulæ the bladders dilated well in 4 of the cases, and I had no trouble in seeing the ureteral orifices, most important anatomical points to determine before closing the fistulæ. In the case of vesico-vaginal fistulæ where I was unable to make a satisfactory examination, there was a stricture of the urethra, so that I had to use a No. 7 cystoscope, and it caused the patient so much pain that an examination in both positions failed. As stated in the cases where local applications were made for cystitis or the bladder examined for diagnostic purposes the exposure was all that could be desired.

The method of examining the patient is as follows:

1. The patient's bladder must be empty. Either have the patient urinate, which is the better way, or else catheterize her in the dorsal position.

2. The patient assumes the Sims posture on the table, or if a very ill patient, on the bed, i. e., she lies on her left side with both knees and thighs flexed and the right thigh drawn well up above the left; her left arm should be back of her, either hanging over the edge of the table or lying on it, parallel with her back. Her chest should be inclined forward so that she rests upon it. The buttocks must be at the edge of the table or bed.

All the details in this posture must be observed. Both thighs must be flexed, the left as well as the right, and the right thigh must be flexed more than the left in order to permit an exposure of the urethral orifice and also to increase the inclination of the pelvis.

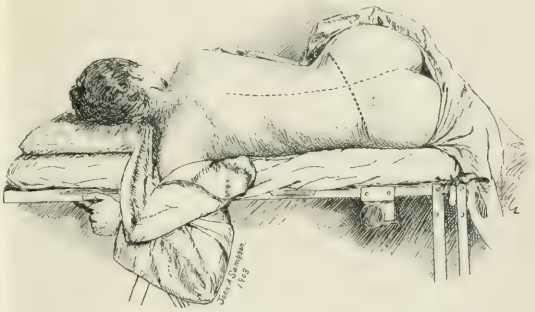
By referring to the illustration which was drawn from a photograph, one can see the effect of this posture on the pelvis.

a. The pelvis is tilted forward as shown by the line drawn across the back from the top of the two iliac crests, and as also shown by the curve in the vertebral column.

b. The pelvis is at the same time elevated.

The effect of the tilting forward of the pelvis with elevation is that the pelvic contents tend to fall out and so we have the same conditions present for atmospheric distention of the bladder, vagina and rectum as in the knee-breast posture, only not as great. In many instances, further elevation of the buttocks is not required.

3. The urethral orifice is now exposed by using two cotton pledgets one on each labia to hold them apart, thus preventing slipping and making the cleansing of the orifice easier. The urethral orifice is cleansed with pledgets which have been boiled in water—use ten pledgets and wipe dry with a sterile dry one. Inject a few cc. of a 10 per cent solution of cocaine into urethra. Leave a pledget in contact with the urethral orifice until ready to examine bladder.



Illustration, Made from a Photograph, Showing Effect of Sims Posture on the Pelvis.

The pelvis is tilted forward as shown by the line drawn across the back from the top of the two iliac crests, and is also shown by the curve in the vertebral column. At the same time the pelvis is elevated slightly. The effect of the tilting forward of the pelvis with elevation is that contents of the pelvis tend to fall out and we have the same condition present for atmospheric distention of the bladder, vagina, and rectum as in the knee-chest posture, only not as great. In many instances, further elevation of the hips is not required. If greater distention of the bladder is desired, it may be accomplished by placing pads under the hips or better by elevating the end of the table.

4. First place a speculum or spatula into the vagina and let that dilate. This is very important no matter whether the patient is examined in the Sims or knee-breast posture. The dilatation of the vagina keeps the trigonum of the bladder from dilating backward when the bladder is examined, and so permits a much better inspection of it.

The urethra is now exposed, dilated if necessary, and the cystoscope is inserted. On removing the obturator the bladder will dilate and its entire mucosa can be examined as in the knee-breast posture. In many instances it is not necessary to elevate the hips, but should the bladder not dilate sufficiently this may be accomplished by placing pads beneath them, or better by raising the end of the table. Thus any degree of dilatation of the bladder possible in a postural distention can usually be obtained.

For physicians who are more dextrous with their right hand the above position is preferable; on the other hand, for those who are left-handed the patient can assume the same posture lying on her right side. As the left urethral orifice is usually seen more readily than the right when the patient assumes the left lateral posture, so the right one will be seen under the same advantages when she assumes the right lateral position.

Judging from the cases which I have examined in this posture, it would seem that it usually afforded the operator all the advantages of the knee-chest posture, a few additional ones, and was free from the disagreeable features of the other.

1. It is not only an easy posture for the patient to assume, but it can also be maintained for a long time without discomfort, a feature which is not only important in the treatment of ill patients but also of those who are in other respects strong and well.

2. The position is a passive one. The patient assumes or is placed in it and once in it does not have to be taught "to bend her back in."

3. The position seems to me to be the least obnoxious one the patient could possibly assume for such treatment.

4. There is less exposure of the patient; the opening in the sheet may be very small and the patient may be completely covered except for this opening.

5. In many cases elevation is not required. The posture, by tilting the pelvis and at the same time elevating it slightly, permits of enough distention of the bladder for a satisfactory examination. Should any elevation be necessary the head can be elevated at the same time, thus obviating in all instances, except where extreme elevation is required, the disagreeable features of the head being lower than the body.

6. Any degree of distention of the bladder possible in a postural distention can usually be obtained by elevating the hips either by placing pads under them or better by elevating the end of the table. When the patient is not elevated the bladder does not distend as much as in the knee-breast posture, a very desirable feature for the trigonum can be the more readily inspected, as well as other portions of the bladder. On the other hand, by elevation one can generally get as great a distention as in the other posture.

7. If for any reason a general anesthetic is required, it is much easier to administer it to a patient in this position than in the other.

8. The exposure of the ureteral orifices varies in different cases. In one group of cases the long axis of the pelvis seems to bisect the trigonum. When it does so the left ureteral orifice is usually seen as easily as in the knee-breast posture and the right or upper one not quite as well. In a second group the trigonum has apparently been drawn down, making the right orifice nearer the long axis of the pelvis than the left. In such instances both ureteral orifices may be seen as readily as in the other position. There is still a third group and that is where the trigonum has apparently been raised and one sees the left ureteral orifice nearer the long axis of the pelvis than the right. In such cases the left ureteral orifice is seen more readily than in the other two conditions, but the right is more difficult to expose. The most extreme case of this kind which I have seen, is in a patient with right pyelitis following pregnancy. I have catheterized the right ureter twice and irrigated the pelvis of the kidney, and plan doing so twice a week until either the pyelitis clears up or other measures are indicated. While the exposure of the orifice is a little awkward, nevertheless I have no trouble catheterizing the ureter. Since the patient is weak and it would be very difficult for her to assume the knee-breast posture, I have not had an opportunity to compare the exposure of the right ureteral orifice in the two postures.

As I have examined only 20 women in this posture I am unable to draw any conclusions as to the relative frequency of the three groups mentioned above.

In the knee-breast posture the exposure of the urethral orifice and thus the introduction of the cystoscope is easier than in the Sims. This advantage is appreciable especially in fleshy individuals, but if one uses cotton pledgets to hold the labia apart, as I have described, one will experience but very little difficulty even in these cases.

There are certain cases where the knee-breast posture gives a better exposure of the bladder than the Sims. I had one such case, a nullipara, twenty-two years old, who was very fleshy. The bladder dilated very little when the patient was in the Sims posture, even when the end of the table was elevated, but on placing her in the knee-breast position a very satisfactory view of the bladder was obtained. The thick abdominal walls relaxed more when she was in the knee-breast posture, thus permitting a greater distention of the bladder. I have examined the bladders of other fleshy women in the Sims posture, and found it satisfactory, but they all had born children and their abdominal walls were more flaccid than in the above mentioned case.

We have then in the Sims posture one which is very easy for the patient, and in most cases satisfactory for the physician, and should an occasional instance arise, as the above, where one cannot obtain a good exposure of the bladder in this posture, the knee-breast or elevated dorsal position may be tried to see if they are better adapted to the individual case. All three postures have their limitations in certain cases.

The knee-breast posture has been the one most generally used in this hospital. Occasionally the elevated dorsal is used in patients who are too ill to assume the knee-breast posture. I have been on the gynecological staff of this hospital since October, 1900, yet in that time I have seen the elevated dorsal position used but twice and never knew of the Sims posture having been used until I used it in April of this year. On making inquiry I find that there have been a few instances in this hospital where patients who were too ill to be held in the knee-breast posture have been placed on their side, their hips were then elevated and thus a cystoscopic examination made.

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BICHAT.[1]

By William Sydney Thayer, M. D.,

Associate Professor of Medicine, The Johns Hopkins University, Baltimore.

It is fitting that in 1902, the one hundredth anniversary of the death of Bichat, we should contemplate for a moment the career of one of the most remarkable men of modern times. Marie François Xavier Bichat was born in Thoirette in the province of Bresse, now Jura, on the 14th of November, 1771. His father was a physician and mayor of Poncin in Bugey. The early life of young Bichat appears to have been uneventful. It was the wish of the father that his son should follow in his footsteps, and whatever advantages one may gain from being brought up in a medical atmosphere the young man seems to have had. Bichat was brilliant from infancy and history shows that he was a striking exception to the common rule, in that this youthful precocity was in no way delusive. At school in Nantua and at the Seminary of Saint Yrénée in Lyon, he gained prizes and honors, and soon manifested a tendency toward mathematics and the natural sciences, especially physics and natural history. Beginning the study of anatomy at the hospital in Lyon under the direction of the celebrated Petit, he made good progress despite the fact that he appears at times to have allowed his exuberant energy and spirits to carry him into channels which deviated somewhat from those which ordinarily lead to a career in science. As Levacher[2] says, he was at this period more fitted to take a rapid bird's-eye view of all parts of the subject than to devote himself to the profound study of a single branch. But his memory and power of comprehension were remarkable, and early in his career he began to apply the accurate methods of thought and investigation which he had learned in mathematics and physics to the study of the structure and functions of man.

Returning home to pursue his surgical work with his father, he was soon drawn again to Lyon and to his mathematical studies, without, however, abandoning anatomy. But in 1793, the stormy days of the Revolution closed the doors of all institutions of learning at Lyon and drove Bichat forever from the scenes of his boyhood. After a short sojourn in Bourg he went

[1] Read before the Johns Hopkins Historical Society, December 8, 1902.

[2] Levacher de la Feutrie, Éloge de Bichat, Mém. Soc. d'émulat, Par., 1803, v, pp. xxvii-lxiv.

to Paris to continue his studies which were to fit him for the position of surgeon in the army. Arriving in Paris without friends or letters of introduction he devoted himself especially to the clinic of the celebrated surgeon Desault, to whose attention he was brought soon after his arrival, through circumstances happily related by Buisson.[3] "It was an established custom in the school of Desault that certain chosen pupils should undertake to collect in turn the public lesson and prepare an extract. This extract was read after the lesson of the following day; and these exercises, presided over by the associate surgeon, had the double advantage of bringing a second time before the pupils the useful precepts which they should absorb, and of making up for the sufficiently common



inattention of the masses during the first lesson. One day when Desault had spoken for a long time on a fracture of the clavicle, and had demonstrated the utility of his bandage, applying it at the same time to a patient, the pupil whose duty it was to collect these details happened to be absent. Bichat offered to take his place. The reading of his extract caused a real sensation. The purity of his style, the precision and clearness of his ideas, the scrupulous exactness of his résumé were characteristic rather of the professor than the pupil. He was heard with extraordinary attention and left showered with praise and repeated applause." When informed of the incident by his associate Manoury, Desault straightway sought the acquaintance of this promising disciple, in whom he soon recognized a man of genius. The master not only opened his house to the pupil, but practically adopted him as a son, and throughout the remaining years of his life Bichat was associated with all the work of his teacher. This was the turning point in his life. His association with Desault opened to him the opportunity for a scientific career to which his whole energy was afterwards devoted.

In 1795 Desault died. Though a great sorrow to Bichat, the death of his master and benefactor in no way interrupted his career. He continued to live with Desault's widow who thenceforth regarded him as a son. From the death of Desault, Bichat gave himself up to a career of unremitting activity such as has rarely been equaled. In the very year of Desault's death he published his journal with an historical notice of his life and letters, and later edited his surgical works. But his main energies were devoted to the study of anatomy. The knowledge of anatomy he found in a condition which may justly be called chaotic. As one biographer has said,[4] "The general anatomy of man was unknown." Much that was taught consisted of a mass of hypothetical or dogmatic statements which had been handed down from master to pupil for ages. In the words of Husson,[5] "Up to that time bristling with scholastic minutiæ, anatomy repelled too often by its dryness the young who were destined to the study of the healing art. We cannot even to-day" [the year of Bichat's death] "recall without a sensation of pain all those multiple divisions, those fatiguing descriptions, that conventional and often incomprehensible language which constituted then the science of anatomy. Bichat was the first to leave the common path; he presented anatomy in a new point of view; studied the general organization of man in the simple tissues of which he is composed, divided the living economy into various systems, and by accumulating facts, by bringing observation to bear on experience, he broadened the limits of science and built for himself a monument which brings him lasting renown." Bichat's great work consisted in the introduction into anatomy and physiology of methods of accurate, systematic observation and experiment, methods similar to those which distinguished the later clinical schools of Laennec, Louis, and the physiological studies of Claude Bernard. "Anatomy," said he one day to his colleagues, "is not as they teach it to us, and physiology is a science to be made over again."[6] Bichat devoted himself literally day and night to his studies, and unmoved by the stirring and distracting incidents of this turbulent period, lived among his cadavers, writing the protocols of his observations and experiments in the small hours of the night. He soon gathered about him enthusiastic pupils and friends to whom in 1797 he gave his first course in anatomy. "From this moment," says Levacher,[7] "one must measure his success by his productions, and his years by his successes."

[3] Buisson: De la division la plus naturelle des phénomènes physiologiques considérée chez l'homme, avec un précis historique sur M. F. X. Bichat. 344 pp., 8°, Paris, Brosson, an. x (1802), p. 326.

[4] Knox: Lancet, Lond., 1854, ii, 393.

[5] Notice historique sur la vie et les travaux de Marie-Fr.-Xav.-Bichat, in Traité des membranes &c. par X. Bichat. Nouvelle édition augmentée d'une notice &c. par M. Husson., Par., 8°, Ann. xi, 1802.

[6] Pariset: Discours à l'inauguration de la statue de Bichat à Bourg. Gaz. méd. de Par., 1843, 2 s., xi, Ann. xiv,"566.

[7] Loc. cit.

He was one of the founders of the Société médicale d'émulation, in the proceedings of which his earlier works were published:

Description d'un nouveau trepan (vol. ii des Mémoires de la Soc. méd. d'émulation).

Mémoire sur la fracture de l'extrémité scapulaire de la clavicule (Ibid.).

Description d'un procédé nouveau pour la ligature des polypes (Ibid.).

Mémoire sur la membrane synoviale des articulations (Ibid.).

In this latter publication he introduces his ideas concerning the distinction of tissues which were afterwards elaborated in his general anatomy. Synovial membranes are described for the first time.

Dissertation sur les membranes et sur leurs rapports généraux d'organization" (Ibid.).

Next there appeared: *Mémoire sur les rapports qui existent entre les organes à formes symetriques et ceux à forme irregulière* (Ibid.).

Here he introduces his theory of the two lives, the animal and organic.

In the same year, when barely twenty-nine years of age, he was appointed adjunct physician to the Hotel Dieu.

Finally, in 1800, he published his first great work, *"Traité des membranes en général et de diverses membranes en particulier," Par., 8°, 1800,* an admirable example of accurate, systematic anatomical description. Here he recognized the fact that not only the organism as a whole, but individual organs are composed of various tissues which may be distinguished one from another and which have notable individual characteristics. In his own words: "Chemistry has its simple bodies which by the diverse combinations to which they are susceptible, form compound bodies . . . In like manner anatomy has its simple tissues which by their combinations . . . form the organs."[8]

During the same year he published what is perhaps his most celebrated work, *"Recherches physiologiques sur la vie et la mort."*

This work consists of two parts: the first theoretical, in which he distinguishes the animal life from organic life; the second, experimental, in which he endeavors to determine the rôle of the brain, the heart and the lungs in producing death. The book contains a mass of interesting physiological observations and theories, many of which are classical. Such, for instance are his observations on the action of red blood on the life of the brain, the action of venous blood in various functions, the functional independence of the brain and the heart. His theories, though ingenious, have in many instances suffered modifications with the lapse of years, but his observations and methods of research are models for all time.

Bichat's position in the Hotel Dieu gave him increased opportunities for the study of disease in the living and for the comparison of clinical and anatomical observations. Of these opportunities he made the most, seeking every chance to add to his experience by acting as substitute for his colleagues. In one winter he made over six hundred autopsies.

In 1801 appeared his *"Anatomie générale appliquée à la physiologie et à la médecine,"* a work memorable not only for its anatomical observations but for the remarkable applications which Bichat makes of these observations to physiology and pathology. "Pathological anatomy," says Cérise,[9] "which



was but a collection of isolated facts, is here raised to the rank of a science. . . . Medical genius has never at a single bound raised itself to so great a height." In the preface to this treatise he speaks of the methods of study which have led him to the results set forth in the work. How modern are his words! "Experiments on living animals, tests with various reagents on organized tissues, dissections, necropsies, observation of man in health and disease, these are the sources from which I have drawn; they are those of nature. Nor have I neglected those of the authors, especially of those for whom the science

[8] Anatomie générale &c., p. lxxix.

[9] Cérise: Œuvres du Docteur, Par., 1872, vol. ii, p. 403.

of the animal economy has been a science of facts and experience." Nature was indeed his text-book, and on one occasion he is reported to have said, "If I have made such rapid headway, it is because I have read little." [10]

The relations of pathological anatomy to clinical medicine have rarely been better expressed than in the following words: "We are, it seems to me, at a point where pathological anatomy must take a new flight. It is not alone the science of those changes which primarily or secondarily develop gradually in the course of chronic disease; it includes the examination of every alteration to which our parts are subject at whatsoever period of the disease. . . . How petty are the reasonings of a multitude of physicians great in the eye of the public, when investigated not by the light of their own writings, but in the cadaver! Medicine has been for a long time excluded from the exact sciences; it will have a right to be associated with them at least as regards the diagnosis of disease when one shall have combined everywhere with rigorous clinical observation the examination of the alterations suffered by our organs. . . . Of what value is clinical observation if one is ignorant of the seat of the evil? You might take notes at the bedside of the sick for twenty years from morning to night on affections of the heart, of the lung, of the abdominal viscera, &c., and there will be but confusion in the symptoms, which resting upon no certain base, will of necessity bring before you an incoherent sequence of phenomena. Open a few cadavers and that obscurity which clinical observation alone could never have dissipated will vanish in a moment from before your eyes." [11]

Realizing early the traditional, blind, therapeutic empiricism which then prevailed, Bichat became deeply interested in the physiological action of drugs and made many careful, systematic pharmacological experiments on animals. His power for work was little short of marvelous. He began a treatise upon descriptive and pathological anatomy, working all day and writing much of the night, but with such extraordinary rapidity, accuracy and clearness, that his pages are said to have gone unread and uncorrected from his pen to the printer. Young, attractive and spirited, the few moments which he snatched for the more ardent pleasures of life, came not from his hours of work, but from those which should have been devoted to rest and recuperation—and the end was the old familiar one. One day an attack of hæmoptysis, the moments of discouragement soon forgotten, the old manner of life renewed, several repetitions of the accident, frequent "gastric disturbances," and finally, after a hot July day spent among decomposing bodies in an atmosphere so foul that it had driven all his associates from the laboratory, an attack of syncope, a fall, followed shortly by an "ataxic fever" which proved fatal on the 14th day, the 22nd of July, 1802. He died in the arms of his master's widow, to whom he had been for seven years a devoted son.

[10] The Practitioner, Lond., 1896, lvi, 280.

[11] Bichat: Anatomie générale, &c. Nouvelle édit., Paris, 1812, Brosson et Gabon, t. I, p. xcviii.

"He was," says Larrey,[12] "but thirty years old, but he was already the greatest physiologist of his century, as he must have been the greatest physician had he but lived twenty years more."

Bichat seems to have possessed, in addition to his genius, a character in many ways remarkable. With all his powers and his restless energy, he was a modest, affectionate and singularly lovable man, incapable of jealousy or resentment and devoted to his friends. "If," says Pariset,[13] "we may believe Fénelon, few men have the strength to support the talents which they have received from heaven. I venture to assert that Bichat belonged to this small number of favored men." Roux,[14] a companion and student, who for several years held most intimate relations with Bichat, speaks feelingly of his remarkable



and genuine modesty. But now and then some slight act would reveal to his more intimate associates the consciousness of his own strength, and once, in a tête-a-tête with Roux he said, apropos of his own career: "J'irai loin, je crois."

He died without leaving the wherewithal to provide for his funeral, but he was piously cared for by his friends, while all the professors of the faculty and 600 students followed his remains to the grave.

His death caused profound emotion throughout the medical profession. Corvisart wrote to Napoleon, then first consul: [15]

[12] Larrey: Discours prononcé à l'inauguration de la statue de Bichat, 8°, Paris, 1843; also Gaz. méd. de Par., 1843, xiv, 2 s., xi, 569.

[13] Loc. cit.

[14] Gaz. méd. de Par., 1845, 2 s., xiii, 763.

[15] Larrey: Inauguration de la statue de Bichat le 16 juillet, 1857, à la Faculté de Médecine de Paris. Discours de Larrey au nom de la Société médicale d'émulation.

"Bichat has just died at the age of 30; he has fallen upon a field of battle which, also, calls for courage, and which counts many a victim; he has broadened the science of medicine; no one at his age has done so many things and done them so well." And Napoleon, wishing to honor both Bichat and his master, wrote to the Minister of the Interior: "I beg that you will have placed in the Hotel Dieu a marble dedicated to the memory of Citizens Desault and Bichat which shall attest the gratitude of their contemporaries for the service which they have rendered, one to French surgery, of which he is the restorer, the other to medicine, which he has enriched by many useful works. Bichat would have broadened the domain of this science, so important and so dear to humanity, if pitiless death had not struck him down at the age of 30." The monumental stone upon the wall of the peristyle of the Hotel Dieu has for an inscription an extract from this memorable letter.

Since this time the memory of Bichat has not faded. In 1833 the Société d'émulation de Jura erected a commemorative stone by the house in which he was born in Thoirette. In 1837, David, charged with the duty of designing the frieze on the façade of the Pantheon upon which are inscribed the fine words, "Aux grands hommes la partie reconnaissante," represents Bichat dying, his head crowned with laurels. In one hand he holds a pen, and in the other the manuscript of his work, "Sur la vie et la mort."

In 1839 a monument was erected in honor of the memory of Bichat at Son-le-Saulnier, *chef-lieu* of the department of Jura, a column surmounted by a bronze bust by Huguenin.

In 1843 a fine memorial was dedicated at Bourg en Bresse. The statue by David (d'Angers) represents Bichat in an attitude of meditation, his hand seeking the impulse of the heart of a child who stands by his side—at his feet a partly dissected body and a lamp, symbolizing the light which his genius had cast upon the obscurities of life and death.

In 1857 the statue, also by David, which stands in the quadrangle of the school of medicine at Paris was unveiled.

In 1844 the city at last granted a fitting burial place for Bichat at Père-La-chaise, and on the 16th of November, 1845, forty-three years after his death, his remains were solemnly exhumed before a committee of the Medical Congress of France and carried to Notre Dame, where obsequies were held; thousands marched in the funeral procession.

And again last summer the Société Française d'histoire de la médecine celebrated the centennial anniversary of his death by a visit to his tomb, the placing of an inscription upon the house in which he died, and literary exercises in which addresses were made by a number of distinguished members of the profession. A medal has been struck in honor of the occasion.

Looking back upon the life of this truly great man one cannot but feel the inspiration of it all. And though reason remind us that 'tis a career rather to admire than to emulate, yet one must be stirred by the fine words of Levacher,[16] addressed to the members of the society which owed so much to his influence and labors:

"Let Bichat be at the same time the guide and the model. He has shown what one could do in but a little while. What an example for you young men who are pursuing the same career. You are witnesses of the regret which he carries with him; of the tears which he has caused to flow, and of his triumphs; take him for an example. Be as he was, active and laborious, patient and zealous, and if you need to sustain yourselves in your work pronounce the name of Bichat. Remember above all that time adds nothing to glory and that with genius and work thirty years of life suffice to render one's name immortal."

[16] Mem. Soc. méd. d'emulat., Par., 1803, v, pp. xiv-xxvii.

SOME EARLY AUTOPSIES IN THE UNITED STATES.*

By Walter R. Steiner, M. D.,

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The date of the first autopsy performed in the United States is unknown. Toner[1] from two researches decided that the one made by Johannes Kerfbyle, a Dutch physician and a Leyden graduate, on Governor Slaughter, of New York, in 1691, was the first recorded. Packard[2] in his entertaining book on the history of medicine in the United States describes one done in 1674 as the earliest. He also relates four others of a little later period. There are, however, a number on record a good many years previous to these. For the references to all of them save the two performed in Maryland I am indebted to Dr. Hoadly's article.[3]

In September, 1639, Winthrop[4] tells us in his history of New England that Marmaduke Percy, of Salem, was arraigned for the death of his apprentice boy. "This boy was ill-disposed, and his master gave him unreasonable correction and used him ill in his diet. After, the boy gate a

*Read before the Johns Hopkins Hospital Historical Club, October 13, 1902.

[1] Toner, Contributions to the Annals of Medical Progress, Washington, 1874, p. 57.

[2] Packard, The History of Medicine in the United States, Philadelphia, 1901, pp. 62-63.

[3] Hoadly, Some Early Post-Mortem Examinations in New England. Proc. Conn. Med. Soc., Bridgeport, 1892, pp. 207-217.

[4] Winthrop, The History of New England, Boston, Edition of 1853, i, p. 384.

bruise on his head, so as there appeared a fracture in his skull, being dissected after his death."

The Maryland Archives contain an interesting account of a post-mortem examination, done in 1643, on an Indian lad who was killed by his master, John Dandy.[6] A jury composed of twelve men formed the inquest. Their foreman, George Binx, was a licentiate in physic and probably performed the autopsy. There was, however, another doctor on the jury, Robert Ellyson, a barber chirurgeon. The report reads as follows:

"We find that this Indian (named Edward) came by his death by a bullett shot by John Dandy which bullett entered the epigastrium near the navell on the right side, obliquely descending & piercing the gutts, glancing on the last vertebra of the back, and was lodged in the side of Ano.

foreman

George Binx."

Fourteen years later Mr. Richard Maddokes and Mr. Emperor Smith, chirurgeons, view the body of Henry Gouge, who was thought to have been killed by his master, the above John Dandy. The eleven men who formed the inquest report "that we can See nor find nothing about the Said head, but only two places of the Skin and flesh broke on the right Side of the head and the Scull perfect and sound, and not anything doth or can appear to us to be any cause of the Death of the said Gouge." They also endeavored to search the body, but could not possibly do it, it being "so noysome" to them all.[6]

Referring to the loss of Rev. Mr. Danforth's three children, in an epidemic in 1659, Cotton Mather[7] says that "the (until then unknown) malady of 'bladders in the wind-pipe' invaded and removed many children; by opening of one of them the malady and remedy (too late for very many) were discovered." Diphtheria and tracheotomy are probably here implied.

Elsewhere in his Magnalia, Mather[8] makes the following note: "As for Mr. Stone if it were *metaphorically* true (what they *proverbially* said) of Beza, that 'he had no gall,' the physicians that opened him after his death found it *literally* true of this worthy man." This autopsy on Rev. Mr. Stone, who was assistant pastor of the first church of Christ in Hartford, was probably performed by Dr. Bryan Rossiter, of Guilford, Conn., in July, 1663. Rossiter had previously prescribed for Stone, and had been paid ten pounds for it by the town of Hartford.[9]

"We do not know where Dr. Rossiter obtained his medical education, but Dr. Hoadly thinks it was in England. He came to this country, in 1630, with his father, and was made a freeman a year later of Dorchester, Mass. In 1639 he moved to Windsor, Conn., became town clerk there, and was admitted to practice in the State of Connecticut by the General Court, 'being first tried and approved by Mr. Hooker, Mr. Stone, and old Mr. Smith of Wethersfield, in the face of the said Court.'[10] He migrated later to Guilford, and was continually in hot water with the people of the town about the union of New Haven Colony with Connecticut. He finally moved to Killingworth (now Clinton), but soon returned and died in Guilford, in 1672. "His practice was very large and he was frequently called to see cases in all parts of the State."

In the following extract from a letter to his daughter and her husband, on September 24, 1669, we get some idea of his busy practice: "We have had a sore visitation again by sickness and mortality here in Guilford this summer, as the last. Our graves are multiplied and fresh earth heaps are increased. Coffins again and again have been carried out of my doors. I have taken up a lot amongst the tombs in the midst of them."[12] During this "visitation" he lost his wife, his daughter and a grandchild.

For some reason or other he incurred the enmity of Gov. Leete, of Guilford, and whenever medical services were required in Leete's family Gov. Winthrop, that worthy colonial physician and statesman, was appealed to for aid. In 1658, Leete[13] details to Winthrop an eye trouble which affected his son, Peregrine, aged nine weeks, and in a later letter[14] asks Winthrop's directions concerning cordial powder the latter furnished Leete's wife by John Crane, for Graciana their daughter. It seems that no information accompanied the powder about the taking of it. Leete says: "Truly one of the most needfull directions is how to make her willing & apt to take it; for though it seemes very pleasant of itselfe, yet is she grown so marveilous aukward & averse from takeing it in beer. Wherefore I would entreat you to prescribe to us the varyety of wayes in which it may be given soe effectually; wee doubt els it may doe much lesse good, being given by force only." On another occasion he writes in a foot-note,[15] "my wife entreats some more of your physick, although shee feareth it to have very contrary operations in Mr. Rossiters stomach"[15]—a suggestion that professional jealousy existed in those days.

Rossiter's fame as a physician called him also to Hartford, in 1662, to ascertain by an autopsy whether the child of John Kelly was bewitched. The child was a girl, aged eight years, who "was taken in the night following Sunday, March 23, 1661-2, with a violent attack of something like bronchopneumonia. In her delirium she cried out against Goody Ayres as choking her and afflicting her, and the last words the child

[6] Provincial Court, i, pp. 254-255 and 260.

[6] Provincial Court, ii, pp. 524-525. For a fuller account of these two autopsies see my paper entitled, A Contribution to the History of Medicine in the Province of Maryland. Johns Hopkins Hospital Bulletin, 1902, xiii, pp. 192-198.

[7] Mather, Magnalia, Hartford, Edition of 1853, i, p. 437.

[8] Mather, Magnalia, Hartford, Edition of 1853, ii, p. 64.

[9] Conn. Hist. Soc. Coll., Hartford, 1897, vi, p. 108.

[10] Stiles, Ancient Windsor, Hartford, 1891, i, p. 453. The above quotation is taken from a letter Rossiter wrote to Gov. John Winthrop, Jr., in 1669. It is given in full in the Bulletin of the N. Y. Public Library, 1899, iii, pp. 402-404.

[11] Steiner, History of Guilford, Conn., Baltimore, 1897, pp. 477-478.

[12] Smyth, Dr. Bryan Rossiter of Guilford, Conn., and his descendants. N. E. Hist. and Gen. Reg., Boston, 1901, lv, pp. 149-154.

[13] Mass. Hist. Coll., Boston, 1865. vii, 4 Series, p. 539.

[14] Mass. Hist. Coll., Boston, 1865, vii, 4 Series, p. 540.

[15] Mass. Hist. Coll., Boston, 1865, vii, 4 Series, p. 548.

spoke were to that effect."[16] Following the superstition of those times, both her parents and the town's people thought that her death was due to some preternatural cause. The town accordingly summoned a jury of six men to inquire of the cause or manner of her death. They report on March 31, 1662:

"We, whose names are underwritten, were called forth and desired to take notice of the dead child of John Kelley, do hereby testify that we saw as followeth: The child was brought forth and laid upon a form by Goodwife Rescoe and Goodwife Whaples, and the face of it being uncovered, Goodwife Ayres was desired by John Kelly to come up to it and to handle it. The child having purged a little at the mouth, Goodwife Ayres wiped the corner of the child's mouth with a cloth, and then she was desired to turn up the sleeve of the arm, and she did endeavor to do it, but the sleeve being somewhat strait she could not well do it. Then John Kelly himself ripped up both the sleeves of the arms, and upon the backside of both arms, from the elbow to the top of the shoulders were black and blue, as if they had been bruised or beaten. After this, the child was turned over upon the right side and so upon the belly, and then there came such a scent from the corpse as that it caused some to depart the room, as Gregory Wolterton and George Grave. Then the child being turned again and put into the coffin, John Kelly desired them to come into the room again to see the child's face, and then we saw upon the right cheek of the child's face a reddish tawny great spot, which covered a great part of the cheek, it being on the side next to Goodwife Ayres where she stood.

This spot or blotch was not seen before the child was turned, and the arms of the child did appear to be very limber in the handling of them.

Gregory Wolterton,	The Mark of Thos. Catlinge,
Thomas Bull,	Nath. Willett,
Joseph Nash,	George Grave."

On the same day, that is five days after the child's death, Dr. Rossiter opened the body at the grave, described the appearance of the organs, noted the absence of rigor mortis, and mistook the signs of beginning decomposition for something supernatural, in the following protocol:

"All these particulars underwritten I judge preternatural.

Upon the opening of John Kelley's child at the grave I observed:

1. The whole body, the musculous parts, nerves and joints were all pliable, without any stiffness or contraction, the gullet only excepted. Experience of dead bodies renders such symptoms unusual.

2. From the costal ribs to the bottom of the belly in the whole latitude of the womb, both the scarf skin and the whole skin with the enveloping or covering flesh had a deep blue tincture, when the inward part thereof was fresh, and the bowels under it in true order, without any discoverable pecancy to cause such an effect or symptom.

3. No quantity or appearance of blood was in either venter or cavity, as belly or breast, but in the throat only at the very swallow, where was a large quantity as that part could well contain, both flesh and fluid, no way congealed or clodded, as it comes from a vein opened, that I stroke it out with my finger as water.

4. There was the appearance of pure fresh blood in the backside of the arm, affecting the skin as blood itself without bruising or congealing.

5. The bladder or gall was all broken and curded, without any tincture in the adjacent parts.

6. The gullet or swallow was contracted, like a hard fish bone, that hardly a large pease could be forced through.

Br: Rossiter."

Fortified by these findings John Kelly and Bethia, his wife, testify in open court on May 13, 1662, as to the alleged persecutions of their child by Goody Ayres, according to the child's testimony. They state that the child after eating some hot broth with the wife of William Ayres, against their wishes, complained of pain at her stomach. Her father gave her some angelica root which yielded her "present ease," but the relief was only temporary as some time later she died. Fearing then an indictment Goody Ayres fled suddenly with her husband, leaving their son, aged eight, behind them as well as all their possessions. We know nothing of their subsequent history.

At a General Assembly held at Hartford, March 11, 1662-63, the court allowed "unto Mr. Rossiter twenty pounds in reference to openinge Kellies child and his paynes to visit the Dep-Governor and his paynes in visiting and administering to Mr. Talcot."[17]

[16] Hoadly, op. cit. I have been unable to consult the original papers. Dr. Hoadly says some of the material was obtained from Mr. John Carter Brown, of Providence, R. I. The Librarian, Mr. Winship, of the John Carter Brown Library, was unable to find any of the manuscripts for me.

[17] Conn. Col. Records, Hartford, 1853, i, p. 396.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

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A CASE OF NEURO-FIBROMATOSIS (VON RECKLINGHAUSEN'S DISEASE) WITH PARALYSIS AND MUSCULAR ATROPHY OF ARMS AND LEGS.[1]

By H. M. Thomas, M. D.,

Neurologist to the Johns Hopkins Hospital.

Dr. Osler has asked me to demonstrate this patient to the Society, on account of the very great interest of the nervous symptoms which she shows.

The patient is a woman from West Virginia, Cyrena W., æt. 51, single; admitted Oct. 17, 1902, to Dr. Osler's clinic; Med. No. 14,942. Complains of pain and stiffness all over.

The family history is unimportant. She has never heard of a case similar to hers occurring in the family.

She is the eldest of nine children. Has been always rather sickly. Went very little to school and has worked hard on a farm all her life. She had scarlet fever in infancy; diphtheria and measles when 27; "grippe" six years ago. Is subject to occasional headaches. Menstruated first at 16; was fairly regular from then up to 48, when menopause occurred.

Tumors of the skin have been present since early girlhood, but she paid little attention to them and can give little definite information about them. She has, however, noticed a great increase in the last four or five years and she has consulted a physician about them. Those on the face appeared last. She has noticed dark bluish spots on the body for many years.

About five years ago she began to suffer from a burning, stinging pain in her left ankle. This was not constant, but recurred from time to time and was so intense that at first she thought her skirts were on fire. The pains gradually affected more and more of the leg, extending up to the hip and back, the right leg being affected after the left. This pain was at first very severe; each attack would come on very suddenly and last only a second or two. She describes them very much as a tabetic describes lightning pains. For one or two years there has been some pain of a similar character in her arms and shoulders. There are no pains in the face except those which the patient refers to defective teeth.

With the onset of the pains, the patient began to have some difficulty in walking. Her brother first noticed that she limped a little, dragging one leg. The muscular weakness increased gradually and two years ago she had a good deal of difficulty in getting about, and for the last year has been entirely unable to walk. During this year she has spent her time between her bed and her chair, and up to a few weeks ago was able to get from bed to chair unassisted. For about four months her legs have been contracted at the knees and hips. For a little less than a year she has noticed some weakness in her arms, commencing in the right. This has gradually increased, and for about five months she has been unable to knit or sew, and has had difficulty in dressing herself. She has not dressed her hair for several months, but can still feed herself.

From the very first she has noticed muscular twitchings and from time to time she has had some singing in the ear.

She made no complaint about her bladder before admission, but since then has often had to be catheterized, although she is able, at times, to voluntarily pass a little urine.

For the last two or three months she has noticed some difficulty in swallowing—chokes easily. There has been no regurgitation through the nose. For about the same length of time she has noticed that her voice has become thick and weak. She complains of no trouble with her eyes or ears except slight tinnitus.

As you see, the patient is a poorly nourished woman, with a careworn expression. Scattered irregularly over the face, trunk, arms and legs there are numberless little tumors. These vary in size from the little ones, about as large as a pin-head, to those as large as a good-sized cherry, and some few even larger. (See Plate XIII.) Some of these tumors are definitely pedunculated and others are sessile. There are numerous pigmented areas scattered over the body and in several spots the skin has a bluish look, which is apparently due to the coming through of the nodular tumors. Some of the larger tumors feel lobulated and nodular, but most of the masses have a homogeneous consistency. Two of the tumors were excised for histological examination and show the ordinary structure of neurofibromata.

In so far as the skin manifestations go, the patient presents a typical picture of cutaneous neuro-fibromatosis. No definite tumors on the nerve-trunks have been made out, nor have we felt any definite plexiform growths, although the subcutaneous fat below the popliteal space has a curious cord-like feel.

Examination of the nervous system, however, reveals a very remarkable condition, and it is in this respect that I particularly wish to call your attention to the case. The patient is apathetic and somewhat dull. She speaks in a thick, muffled voice, suggesting some weakness of the laryngeal muscles. Her answers seem quite unreliable, especially in regard to dates. I could find no definite abnormality of any of the cranial nerves. There are no changes in the retina or the optic nerve. No definite disturbances of hearing could be made out, although the patient does complain from time to time of subjective auditory sensations. The muscles of the pharynx appear to act well; the tongue is protruded straight, but is slightly tremulous.

The muscles of the neck are strong but all the muscles moving the arms are more or less weak; there is no absolute loss of power in any of these muscles. The muscles of the arms are generally atrophied, but particularly so in the intrinsic muscles of the hand. Fibrillary tremors are noticed in the muscles of both arms, and I think can be seen by those who

[1] Presented to The Johns Hopkins Medical Society, November 17, 1902.

are near the patient. The deep reflexes are present in the arms and fairly active.

As you see, the patient lies on her back with her legs flexed at the hip and at the knee, and the ankle joints extended. There is not much limitation in the hip-joint to passive movements, although there is some contraction of the flexor muscles, but the knees cannot be fully extended and there is apparently some thickening of the knee-joints. One gets a sense of creaking when the knee-joints are moved. There is no limitation of movement of the ankle-joints. The legs are both almost completely paralyzed; no movements of the hip, knee or ankle-joint are present in either leg. The patient can flex slightly the toes of the right foot and in the left foot there is a slight flexion of the little toe. The legs are thin, showing a general atrophic condition of the muscles. Fibrillary tremors in the legs have not been noticed. The knee-kicks are absent and there is no reflex from the tendo-Achillis. Plantar irritation causes no response.

We have been unable to determine any noticeable loss of sensation throughout the body. Patient appreciates touch, pain and temperature as acutely as is normal. This is true for the skin in general, but over some of the nodules there is a distinct loss in the perception of pain; a prick of the pin is not felt as acutely as it is on the rest of the skin.

The facial nerves and muscles react normally to the electrical currents, as, in general, do the nerves and muscles of the arms, although there is, perhaps, some decrease in the excitability of the muscles of the right hand. In the legs there is a profound decrease in electrical excitability of all the nerves and muscles. The only nerves that can be stimulated are the internal popliteal, and to do this it requires currents of very great strength. The resulting muscular movement is a slight flexion of the ankle and of the toes. The muscles on the anterior aspect of the legs do not respond to any strength of galvanic current that I am willing to use. There is a slow response in the calf muscles when directly stimulated by a strong galvanic current.

The general physical examination has revealed no particular abnormality in her heart, lungs or other internal viscera. Her urine is practically normal. Blood: 70 per cent and 83 per cent of hæmoglobin; red blood corpuscles over five million, the leucocytes between seven and eight thousand per cm.

To recapitulate, the essential features of this case are: A single woman, 51 years old, with good heredity and nothing in her personal history of importance. Tumors of the skin have been present from her earliest childhood, but have increased markedly in the later years. For five years she has suffered from sharp, burning, stinging pains in her feet and legs. Weakness of the legs made its appearance with the pains and has gradually increased. For two years she has had great difficulty in getting about, and for the last year she has been unable to walk. Her arms have also become weak. Muscular twitchings have been noticed since the beginning of the weakness. Some weakness of the bladder.

You have seen a woman, covered with innumerable skin tumors, splotches of pigmentation and here and there bluish areas of the skin. She is apathetic and dull, speaks in a thick, muffled voice. We have made out no definite loss of function in any of the cerebral nerves. The muscles of the neck are strong, the arms are generally weak and somewhat atrophied, particularly so in the muscles of the hand. Fibrillary tremors are present in the arms. Deep reflexes in the arms are active. There is particularly complete paralysis of the muscles of both legs, the only voluntary movements being in the toes. Some flexor contracture in the hips and knees; none in ankles. The legs are atrophied; no fibrillary tremors are seen in them. The deep reflexes are lost; no plantar reflex. There is a very great decrease in electrical irritability in the nerves and muscles of legs, indeed in most of them it is abolished. There is some slight decrease in the electrical excitability in the forearm and hand. The facial muscles act normally. No objective sensory disturbance can be determined except over some of the skin tumors, where there is a dulling in the perception of pain.

The diagnosis of the skin condition presents no difficulty; the case is a very typical example of cutaneous neuro-fibromata—the so-called *fibroma molluscum*. These tumors, as von Recklinghausen has shown, are, for the most part, outgrowths of the connective tissue sheaths of the cutaneous nerves, and are often associated with similar outgrowths from other nerves, forming a condition generally called *diffuse or generalized neuro-fibromatosis*, or *von Recklinghausen's disease*. The classification of neuromata in general is in a somewhat chaotic state, and I have had copied the table which Alexis Thomson has suggested in his excellent monograph on neuroma and neuro-fibromatosis, published in Edinburgh in 1900.

The remarkable feature of this case is the association of the paralytic symptoms, and the question is whether these symptoms can be due to analogous growths in some other part of the nervous system. It is well known that tumors of the nerve trunks are common in association with neuro-fibromata of the skin. We have examined all the peripheral nerves that are palpable, but have been unable to determine any nodules upon them or any general enlargement. Although this does not exclude such changes, it makes their presence doubtful. In this connection is it remarkable to what an extent the nerve trunks may be involved by multiple neuro-fibromata without any loss of their function. This is in contrast to the single neuroma which usually produces symptoms.

Neuro-fibromata may develop in connection with the nerve roots within the spinal column; indeed, the cauda equina is a favorite site for their occurrence. When they affect nerve roots above and grow to a sufficient size, they at times make pressure on the spinal cord. There are a number of such cases reported in literature, but the clinical picture which they present is that of a pressure myelitis due to the growth of a tumor. The reflexes are exaggerated and objective sensory symptoms are more or less prominent. Adrian,[1] who is an assistant in the surgical clinic at Strassburg, where von Recklinghausen is pathologist, has published an extensive review

[1] Beiträge zur klinisches Chirurgie, vol. xxxi, 1901, p. 1.

of the literature of neuro-fibromatosis, especially in relation to the complications which occur in this disease. Reference to this article and to his review of the subject, which has just appeared,[2] will show what various nervous symptoms can result from this disease. This is no more than would be expected when we remember that this overgrowth of connective tissue may occur on any of the cerebral spinal nerves as well as in all parts of the sympathetic system. There are cases which follow the typical course of locomotor ataxia and others in which the diagnosis of syringomyelia was made and still more common, those which show a variety of complex motor and sensory paralyses. I have, however, been unable to find a case quite analogous to the one which I have presented to you. This patient shows a gradual loss of power associated with fibrillary contractions, muscular atrophy, loss of the deep re-

stract. Clinically, the case showed spastic paralysis, with muscular atrophy and no sensory changes. The absence of disturbances of sensation with such widespread involvement of the intervertebral ganglia is very remarkable, and may throw some light on our case.

Haushalter[4] has reported a most interesting case of a boy of fourteen, in whom the nervous symptoms were so pronounced and the skin lesions so comparatively slight, that for two years the diagnosis vibrated between myelitis, multiple sclerosis, and finally an unusual form of syringomyelia, until the presence of a skin tumor was noticed. In this case there was a spastic paraplegia with marked sensory symptoms associated with deformity of the spinal column and chest. There was slight ataxia in the arms, internal squint of the left eye and slight optic neuritis on the right side.

CLASSIFICATION OF NEUROMATA.

"NEUROMA."

- TRUE. Neuroma verum ganglio-cellulare — myelinicum / amyelinicum — The occurrence of true neuroma in which ganglion cells are absent is doubtful.
- FALSE.
  - 1. Circumscribed or Solitary Tumors, growing from the connective tissue of nerve trunks, or of the ganglionic enlargements of nerves.
    - Innocent — Fibroma, myxoma, etc. Cysts from liquefaction of solid tumors (myxoma). The clinical "painful subcutaneous tubercle" is included here.
    - Malignant — Sarcoma, spindle-celled, fibro-myxo-sarcoma; cysts from liquefaction of sarcoma.
  - 2. Diffuse overgrowths of the connective tissue sheaths of nerves and of ganglionic enlargements of nerves. Neuro-fibromatosis.
    - Diffuse and generalized fibromatosis of trunks of nerves ("multipleneuromata").
    - Plexiform Neuro-fibromata.
    - Cutaneous neuro-fibromata (molluscum fibrosum).
    - Elephantiasis neuromatosa (pachydermatocele).
    - Pigmentation of skin of nerve origin.
    - "Secondary malignant neuroma," being the sarcomatous transformation of one or other of the above.

    — Various combinations of these.
  - 3. Traumatic or division neuromata.
  - 4. Enlargement of nerves in leprosy, syphilis, tuberculosis.

flexes and marked electrical changes. The trouble first affected the legs and is now involving the arms. There are practically no objective sensory disturbances, although the patient has suffered from sharp shooting pains. The bladder is somewhat affected. If we exclude the lightning pains the symptoms suggest a form of progressive muscular atrophy.

In Zinno's case,[3] which he calls multiple fibromatosis of the spinal ganglia with amyotrophic lateral sclerosis and considers a new morbid entity, the condition is very complex. At autopsy there were found tumors of most of the spinal ganglia, which were so large in the cervical region that they pressed on the spinal cord; together with this there were also the ordinary findings in cases of amyotrophic lateral sclerosis. The connection between the two is not made clear, at least in the ab-

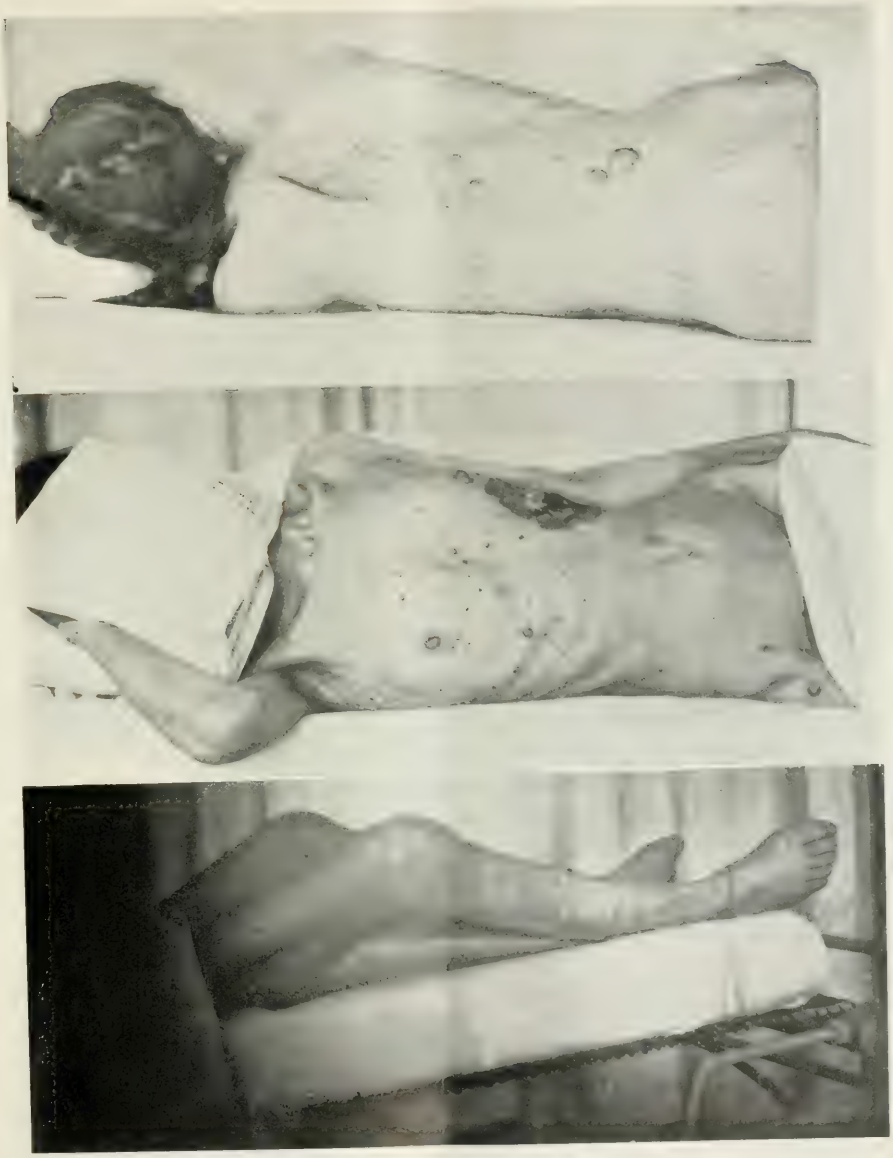
Sorgo's case[5] is still more instructive, as in his patient there were no skin lesions but very marked symptoms from the nervous system. A man of 47 had suffered for five years from intense pain on the right side of back and lower part of abdomen. There was for a time œdema over the lumbar spines which were painful on pressure and motion. Legs gradually became weak and flaccid with muscular wasting. The reflexes were lost. There were marked sensory changes which varied slightly from time to time. The bladder and rectum were paralyzed. The condition remained stationary for a year or more and then the legs gradually became spastic, the reflexes returned and became exaggerated. The sensory changes became more marked. Death followed the development of bed sores and cystitis. The diagnosis was tumor of the spinal

[2] Centralblatt f. die Grenzgebiete der Medizin u. Chirurgie, Bd. vi, 1903, Nr. 4, etc.

[3] Abstr. in Rivista Patologia nervosa e mentale, vol. ii, 1897, p. 524.

[4] Nouvelle Iconographie de la Salpêtrière, Tome xiii, 1900, p. 639.

[5] Archiv f. pathologische Anatomie und Physiologie, etc., Bd. 170, 1902, p. 399.



TO ILLUSTRATE DR. THOMAS' CASE OF NEURO-FIBROMATOSIS.

cord, probably cysticercus. At autopsy numerous tumors were found on the nerve roots of the cauda equina and other spinal nerves, together with two sub-dural tumors, pressing on the posterior aspect of the spinal cord. The larger tumor was between the XI and XII thoracic segments, and the smaller was at the level of the IX. They involved the nerve roots from these segments. There were no tumors on the peripheral nerves nor on the roots of the cerebral nerves. The tumors showed the structure of soft neuro-fibromata, and in the smaller ones it could be seen that the increase of connective tissue began around the individual nerve fibres and was arranged in concentric circles about them, forming an enormous overgrowth of their connective tissue sheaths. In the centers of these concentric circles of connective tissue were the axis cylinders of the nerve fibres, sometimes surrounded by their myeline sheath. The larger tumors were made up by the coalescence of the smaller tumors. In the spinal cord there was pressure myelitis with ascending and descending degeneration, and in the mid-sacral region there was, in the posterior horn, a tumor, which was called a perithelioma. Together with these findings, there was also a wide-spread change in the vessel walls, consisting of a great thickening of the intima and media. Sorgo believes that the flaccid paralysis was due to the neuro-fibromata involving the nerve roots, and that the spastic condition which subsequently developed depended upon the pressure myelitis, causing a condition of hyper-excitability of the reflex arcs. The fact that the axis cylinders persisted in most of the neuro-fibromata on the spinal roots explains why the deep reflexes could again make their appearance, after having been abolished. You may recall that quite analogous occurrences take place in certain tabetic patients, who suffer from a stroke of apoplexy and in whom the knee-jerk reappears in the paralyzed leg. Variability in the symptoms in neuro-fibromata of the nerves has been often noted. Thomson's sixth case, in whom there was a remarkable improvement in the paralysis, is a good illustration of this.

The condition which Sorgo describes of the great overgrowths of connective tissue around the individual nerve fibres recalls the description which Dejerine and Sottas [6] gave of the enlarged nerves in the case which they describe, under the name of "progressive hypertrophic interstitial neuritis of children," and one cannot help wondering whether these cases should not also be brought into connection with the already overburdened disease "neuro-fibromatosis."

The symptoms which these patients showed are a combination of those characteristic of tabes and of progressive muscular atrophy. The peripheral nerves are enlarged and easily to be felt.[7]

Although the symptoms in these cases differ in many respects from those of the patients whom you have seen, they show us what a wide range of nervous symptoms may occur in this remarkable disease, and the post-mortem findings explain why this should be. Indeed, it is not easy to think of any combination of symptoms which might not occur, for every part of the peripheral nervous system may be involved and in every imaginable combination. And nearly all parts of the brain and spinal cord may also be implicated.

In our patient we have a condition which, for the most part, appears to be due to a slowly progressing but a wide-spread involvement of the lower motor segment, and to explain this we can think of neuro-fibromata growing on the anterior roots, those which make up the cauda equina having been first and most affected, while the cervical roots have only lately begun to be involved. It seems strange that with such pronounced motor symptoms we have such comparatively slight sensory phenomena, and although there have been cases described in which the tumor formations appeared to affect only nerve roots of a similar function, it has been the sensory roots that have been selected. Our patient has suffered from the first from shooting pains and in spite of the fact that we have been unable to demonstrate any objective sensory disturbances, I believe that the posterior roots are also involved. You will remember that in Zinno's case there were no objective sensory disturbances, although all the intervertebral ganglia were involved in tumor formations. And in general, objective sensory disturbances are not very common unless the cord itself is implicated.

[6] Comptes rendus hebdomadaires de la Societe de Biologie, Tome v, 1893, p. 63.

[7] Dejerine: Revue de Medicine, Tome xvi, 1894, p. 881.

STUDIES IN TYPHOID FEVER.

SERIES I-II-III.

The papers on Typhoid Fever, edited by Professor William Osler, M. D., and printed in Volumes IV, V and VIII of The Johns Hopkins Hospital Reports have been brought together, and bound in cloth.

The volume includes thirty-five papers by Doctors Osler, Thayer, Hewetson, Blumer, Flexner, Reed, Parsons, Finney, Cushing, Lyon, Mitchell, Hamburger, Dobbin, Camac, Gwyn, Emerson and Young. It contains 776 pages, large octavo, with illustrations. It gives an analysis and study of the cases of Typhoid Fever in The Johns Hopkins Hospital for the past ten years.

The price is $5.00 per copy. Only a few copies of the volume are on sale. Those wishing to purchase should address their orders to the Johns Hopkins Press, Baltimore, Maryland.

THE CURE OF THE MORE DIFFICULT AS WELL AS THE SIMPLER INGUINAL RUPTURES.

By W. S. Halsted, M. D.,

Surgeon-in-Chief, The Johns Hopkins Hospital.

This communication will, I hope, be of interest to friends who have asked for precise information as to the modifications which our operation for hernia has undergone in the process of development during the past thirteen years, and of service to operators who seek to obtain in each instance a result as perfect as possible and who recognize that not infrequently there occur cases of hernia requiring for their cure extraordinary operative procedures. The present operation has been evolved by degrees and stands for the experience of 14 years derived from more than 1000 operations for the cure of inguinal hernia; features of the old where they seemed unnecessary have been dropped and new ones, as they seemed to be indicated, added. To record even the cruder general results of so many operations (upon adults with few exceptions)[1] for the cure of inguinal hernia are required special training, some zeal and a particular honesty of purpose; and for the recognition and interpretation of the nicer facts, keen perception and fine tactile sense are indispensable. A few drops or even a dram of fluid in the tunica vaginalis might readily escape detection, and to determine slight swelling or induration here and there in the epididymis and the relative size of the two testicles may be difficult. A novice can usually discover a distinct recurrence and so can the patient, but I have known an eminent surgeon to overlook a weakness in a scar of his own making sufficient to constitute, without doubt, a recurrence. The surgeon is fortunate and likely to be true to himself whose observations are controlled by mature assistants with large experience in the operative treatment of hernia and who are as eager as he to ascertain and state the exact truth.

If our operation for the radical cure of inguinal hernia has improved, it is due in no small measure to the arduous labors of Dr. Bloodgood, whose valuable contribution[2] should be better known. He established several facts of prime importance from his study of our first 300 cases of inguinal hernia. The majority of inguinal ruptures are now easily and quite well cured by a variety of procedures and by the average operator, hence it is difficult for the student and young practitioner to comprehend that it is hardly more than a decade since this variety of hernia completely baffled the efforts of the best surgeons to cure it. That so simple an operation as Kocher's can cure perhaps many of the milder ruptures, provided the neck of the sac is not too wide, leads to the inquiry whether the features, of these operations, upon which most stress has been laid may not be relatively unimportant, since operations of the magnitude of Bassini's and the author's are not in all cases indispensable. If the transplantation of the neck of the sac can cure so many cases, is it not possible that the transplantation of the cord, which at first was deemed so essential by Bassini and the author, may have owed its success in part to the fact that it made possible this very high closure of the sac's neck? Although for several years our operation, so far as transplantation of the cord and high closure of the sac is concerned, was even more radical than Bassini's (the cord was transplanted into the substance of the divided internal oblique muscle), we were tempted, at the very outset, to test the relative value of cord transplantation in some of the cases, and permitted the entire cord to lie undislocated and altogether undisturbed in its bed and to trust to the suture of the internal oblique muscle to Poupart's ligament, to the "lining of the wound with muscle" to effect a cure. It was well worthy of note, as Bloodgood emphasizes in his article, that all of the cases treated in this manner (cord undisturbed) remained cured. Another fact which Bloodgood's painstaking study established was that of one hundred and nine cases in which the larger bundle of veins of the cord was excised and the healing was per primam, not one showed a recurrence or any weakness at the site of the transplanted vas deferens, whereas in 6.4 per cent of the cases which healed by first intention and in which the veins had not been excised, there was a recurrence at the upper angle of the wound, at the site of the transplanted cord. And even in the wounds which suppurated, there was not a recurrence in the nine cases of vein excision, whereas, of eleven suppurating cases in which the cord-veins were not excised, four (36.3 per cent) recurred. In 118 cases, therefore, in which the larger bundle of veins was excised there was no recurrence at the site of the transplanted cord whether suppuration[3] occurred or not. And, certainly,

[1] The value of an operation for the cure of inguinal hernia can hardly be determined upon children for the surgeon is greatly assisted by nature as the child develops, and he is not confronted with the more difficult problems arising from an undeveloped or an acquired atrophy of the conjoined tendon, or from fatty degeneration and atrophy of the internal oblique muscle. Furthermore, the recurrences have almost invariably followed operations for the cure of very large and old ruptures, such as are impossible in children. And to quote from Bloodgood, "As we have had no recurrences" in children "whether the veins have been excised or not, it does not seem to make much difference what is done with the very small cord."

[2] Johns Hopkins Hospital Reports, vol. vii.

[3] Nine suppurations in 118 cases, and for most of which the author was personally responsible, seems a large percentage (7.6%) even for hernia cases ten years ago, but it was considered a good showing in those days. Since every one, including the operator, has invariably worn rubber gloves, suppurations even in the operations for hernia, has occurred in probably less than 1% of the cases. In 1890, all the assistants at an operation, the nurses and physicians, systematically wore gloves, but the operator wore them only for special operations, such as exploratory laparotomies, explorations for foreign bodies, loose cartilages, etc., in the joints, suture of the fractured patella, etc.—in other words, when there was a possibility of doing serious harm and no certainty of doing great good. By degrees the operator wore gloves more frequently, until Dr. Bloodgood as Resident Surgeon, and who had become thoroughly accustomed to them as assistant, wore them invariably as operator and demonstrated from our statistics the necessity of doing so. It seems to be a fact that one who has been trained to operate always

the cases in which the veins were excised, were not the simpler ones.

One of the most important of the facts ascertained by Bloodgood was the great variation in the width of the conjoined tendon and the responsibility of the insufficient tendon for the recurrences at the lower angle of the wound, through the external ring, direct. The transplantation of the rectus muscle recommended by Bloodgood [4] to close this defect seems to accomplish what its originator hoped it might, although, a priori, one would fear that this powerful straight muscle must eventually draw away from Poupart's ligament to which it had been sewed. Is it not conceivable, however, that a new encompassing fascia may develop about a transplanted muscle and that this fascia may remain even after the muscle has been pulled away? Experiments upon animals to determine this point would be interesting. M. Holl, now Professor of Anatomy in Gratz, directed attention many years ago to the part muscles probably play in the determination and development of the fasciæ.

Hence, so long ago as 1896 we recognized, thanks to Bloodgood, the value of the excision of the veins of the cord and the necessity for paying more attention to the neglected lower angle of the wound. Naturally, it was primarily to the upper angle that we had devoted our thoughts, for, as emphasized in one of the author's articles on the subject, "the cord is the first cause of the hernia and the ultimate obstacle to its cure." And this is true, notwithstanding the fact that recurrences at the lower angle were at first not very rare; for, our attention having been called to these lower angle recurrences, methods to cure them were soon found.

The success attending excision of the veins (one hundred and eighteen cases without recurrence at the site of the transplanted vas deferens) seemed to justify a continuance of this practice, provided it occasioned no undesirable results; but excision of the veins with transplantation of the vas deferens taught us that, not infrequently, a hydrocele, usually insignificant in size, was to be expected, and that in about 10 per cent of the cases atrophy of the testicle had occurred. Atrophy of this organ, however, was observed only in cases complicated by a very considerable swelling of the epididymis, and this observation of Bloodgood's, made so many years ago, has been verified by our study of more than one thousand operations. Great care was exercised, therefore, in excising the veins and, for a short time, a few months perhaps, this procedure was not so invariably practiced by all of us, being reserved for cases which seemed imperatively to demand it. We formerly handled the cord as, I presume, almost everyone still does; separated it, more or less roughly, by tearing, from the sac and its enveloping membranes, and raised it on a hook or strip of gauze preparatory to transplantation and while the stitches were being applied. We now treat the vas deferens with great deference, thanks again to Bloodgood. (Vide description of operation below.)

It occurred to Bloodgood before the publication of his report on hernia that it might be well to split the cord, transplanting only the veins to the outer angle of the wound and permitting the vas deferens to lie undisturbed. This method was finally abandoned by Bloodgood and other members of the staff who had practiced it, because the subtraction of the vas deferens did not appreciably reduce the size of the cord; furthermore, there were one or two recurrences at the site of the transplanted veins. This is a particularly good confirmation of the author's belief that the veins are largely responsible for the development of oblique inguinal hernia. The vas deferens contributes, relatively, very little to the size of most adult cords, but the veins, which at one moment make a bundle as large as one's finger, may the next and when empty be reduced to the size of a small quill. Is not this variation in the size of the cord possibly a factor in the production of hernia? When the hernia is first developing and the sac is, at operation, inside the internal abdominal ring, it can readily be demonstrated by a little pull on the veins. The fat, too, which is recognized as sometimes a probable factor in the production of hernia, accompanies for a short distance the veins rather than the vas deferens. This fat when present should be excised with the veins. For several years, then, we have been excising the veins in this careful manner, leaving the vas deferens untransplanted, undisturbed, and the internal oblique muscle undivided. In a few cases, however, without, that I am aware of, ultimate damage to the testicle, we transplanted the vas deferens to the outer angle of the wound. But we are quite certain that, as a rule, the less the vas deferens is manipulated and the more carefully the veins are excised, the less is the subsequent congestion of the epididymis. It is instructive from day to day to study the stump of the veins, the epididymis, the testicles, etc., after operations for hernia.

It is not the purpose of this communication to give the results in detail of these observations.

In a recent private case, urethritis Neisseri made its appearance a few hours after the operation. We naturally watched the epididymis on the operated side with some concern, fearing that excision of the veins might lower the resistance of this organ. On the twelfth day, without warning, a very slight induration of the epididymis became evident. I attributed

in rubber gloves finds it awkward to operate without them. I have more than once heard my assistants, while performing some insignificant operation without them, call for gloves because, as they said, they were conscious of unnatural finger movements, of a certain clumsiness without them. With gloves one probably acquires special methods of tying knots, holding instruments, etc. In our clinic the heavier gloves are exclusively used, although probably every member of the Staff has by predisposition been in favor of the thinner gloves and had to convince himself by trial of the thinner varieties that the thick ones, even with seams on the fingers, were preferable. The thin gloves were too slippery; also too unsafe, chiefly because of the danger of minute undetected holes. Cotton gloves, if changed very frequently, are undoubtedly better than no gloves at all. If the operator desires the physical property of the cotton which enables him to hold more securely and handle with more precision the intestines and viscera he might wear a very delicate gauze-mesh glove over the rubber or over two or three fingers of the rubber glove. Possibly a rubber glove might be manufactured with a wide gauze mesh permanently imbedded in its palmar surface.

[4] Anton Wöfler, Beiträge zur klinischen Chirurgie (Festschrift f. Billroth), 1892.

this to the fact that the patient carried out his irrigation-treatment badly, for the proper[5] method of irrigation being instituted, the swelling of the epididymis immediately subsided and the urethral discharge promptly ceased.

Four years ago the author used, for the first time, a part of the aponeurosis covering the right rectus muscle to close the lower part of the right inguinal canal. I felt compelled in this case to resort to some such measure, for the internal oblique was fatty and attenuated to a degree not very often seen by us, and the rectus muscle did not seem to promise so much as its fascia did. This patient was a college-mate of mine and for this reason I wished, perhaps, more than ever, to be very sure of the result. One year ago I examined this patient very carefully and was gratified to find as solid a closure as one could desire. I considered the result as perfect as any that I had seen. Dr. Harvey Cushing, house surgeon at the time, made a sketch of this act of the operation, which Brödel has kindly elaborated (vide Fig. VII). This procedure may have a wider application than I have proposed for it. The anterior sheath of the rectus muscle might be employed in the way described whenever the conjoined tendon is insufficient, whether the cremaster muscle can be well used to remedy the defect or not. And Berger[6] has recently suggested using the rectus sheath in much the same way in operations for the cure of inguino-interstitial hernia.

In the upper part of the canal we have strong tissues and plenty with which to close, and hence it was perhaps natural to transplant the cord to the upper angle, to bring it out through thick muscle. But it is not perfectly certain that the cord may not be a useful adjunct in the closing or filling in of the lower angle in some cases, and it is a fact that with Bassini's operation the percentage of recurrence at the position of the transplanted cord in the case of adults has been quite large, probably over 6 per cent. Whatever the truth may be, we have in the excision of the veins a distinct contraindication to transplanting the vas deferens, and thus far we have had no reason to believe that the results would have been better if the vas deferens had been transplanted, as was our custom for several years, to the outer angle of the canal. We may eventually discover that the transplantation of the cord, which Bassini, and at one time the author, considered not only so important, but perhaps the principal feature of the operation, is harmful rather than helpful. Briefly, we may find that not only the vas deferens, but even the entire cord, would be more safely transmitted at the lower angle of the deep wound than at the upper. It would require a very large number of observations to determine this point because the percentage of recurrences is so small in these days; and it is unfair to compare the results of various operations in the hands of various operators. Surgeons do not seem to be agreed even as to what shall constitute a recurrence, or wound suppuration, and, if they were agreed, the personal element would still count for much.

The Use of the Cremaster Muscle.—A device which we hit upon in our efforts to close more securely the lower part of the canal, but which we now make use of as often as feasible, probably in over 75 per cent of the cases, is the utilization of at least a part of the cremaster muscle, which we formerly cut away. This is a step of the operation to which one is irresistibly drawn in some cases by the great strength of the cremaster and the firmness and extent of its attachments to Poupart's ligament. A natural insertion, such as this, of the cremaster and its fascia into Poupart's ligament, has in each case a value which can be demonstrated on the operating table and can be counted upon definitely to contribute something, and occasionally perhaps a great deal, to the strength of the abdominal wall; whereas the artificial insertion of the internal oblique into Poupart's ligament, although undoubtedly of the utmost importance and always to be tried for, may occasionally and perhaps often fail, from insufficient muscle, too great tension, or gradual redressment, to close securely even the upper part of the canal. The lower part of the canal, ordinarily protected by the conjoined tendon, can rarely be entirely safeguarded by the muscle fibres of the internal oblique when its conjoined tendon is deficient. The cremaster, on the other hand, seems in just these cases to serve a particularly good purpose. The cremaster, unaided, has repeatedly made such a complete and strong looking closure that we have felt the hernia would be well cured if the operation were abandoned at this stage.

I have today, June 10, 1903, examined a patient whose very wide inguinal canals (the gap would have admitted the hand) were closed eighteen months ago solely by the cremasters stitched over instead of under the internal oblique muscle; the result, in the opinion of those who examined the case, is absolutely perfect, on both sides. My house surgeon, Dr. Fol-

[5] When the author's method of treating gonorrhœa can fail in his own wards, because improperly understood, it is not strange that so admirable a surgeon as Dr. Orville Horwitz, apropos of Janet's work on the abortive treatment of gonorrhœa by permanganate of potash, should write: "In spite of the claim of quick cures and prevention of complications a length of time elapsed before it began to be generally adopted in this country. The profession was skeptical as to the claims made for its brilliant results. This was probably due to the disappointment which had followed the employment of retroinjections of hot water suggested by H. Holbrook Curtis, and of the continuous irrigation with a hot solution of mercury bichloride, recommended by Dr. W. S. Halsted, which at the outset seemed to offer more benefit to the patient than the conservative methods then in vogue, but resulting after a fair trial by a large number of observers in being found valueless and often dangerous; the employment of these remedies having been found to be attended with great discomfort to the patient and being frequently accompanied by severe complications, such as acute posterior urethritis, seminal vesiculitis, prostatitis, and cystitis." This is not the proper time to tell how one must use the bichloride solutions in order to obtain the best results which have been claimed for it, but to judge from my own experience with this method twenty years ago in private practice, too much has hardly been said in its favor. The bad and indifferent results probably come from mismanagement or misconception. I should be glad at some future time to publish the treatment in detail, for it happens that I have not heretofore described or, in print, claimed anything for the method which rightly bears my name. I agree with Dr. Horwitz that irrigation with hot water is not only useless but dangerous.

[6] P. Berger: La Hernie inguino-intersitielle et son traitement par la Cure radicale. Revue de Chirurgie, Janvier, 1902.

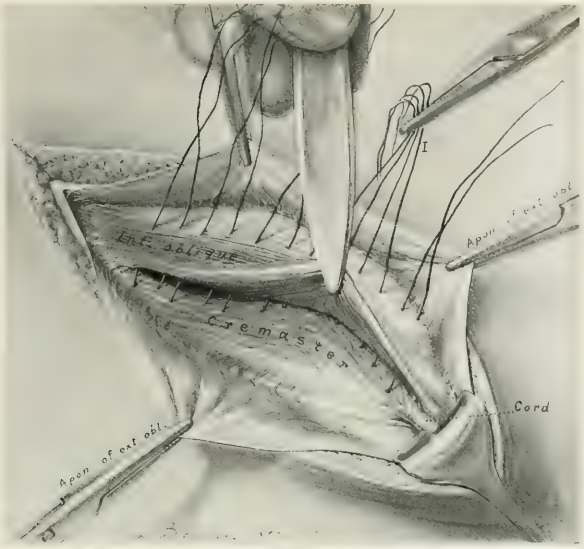


FIG. I.

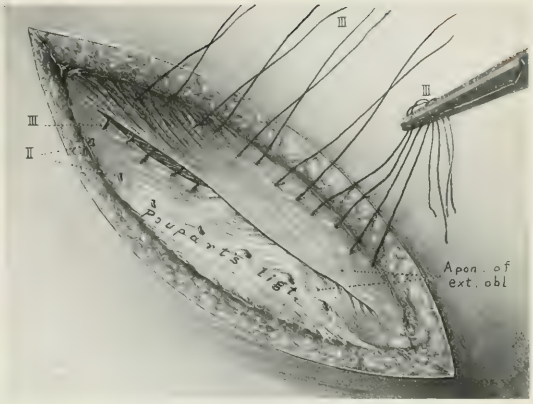


FIG. III.

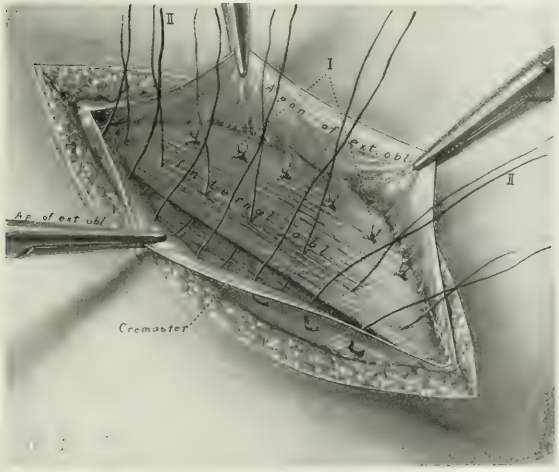


FIG. II.

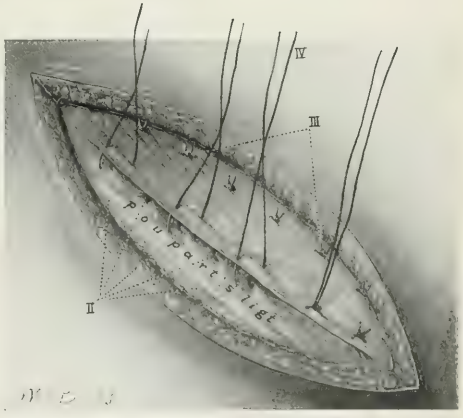


FIG. IV.

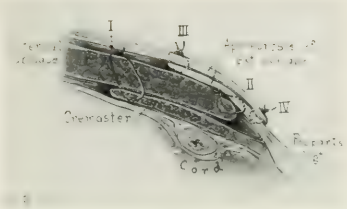


FIG. V.

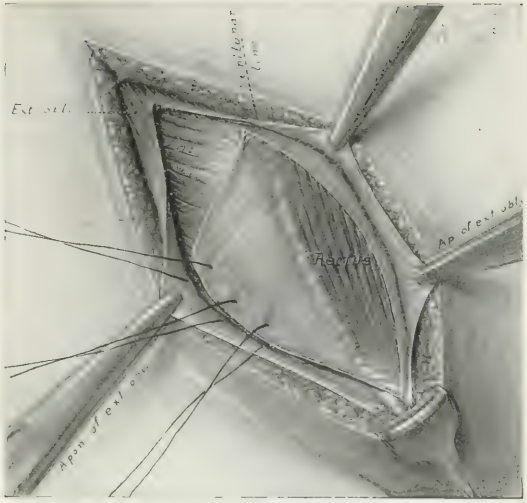


FIG. VII.

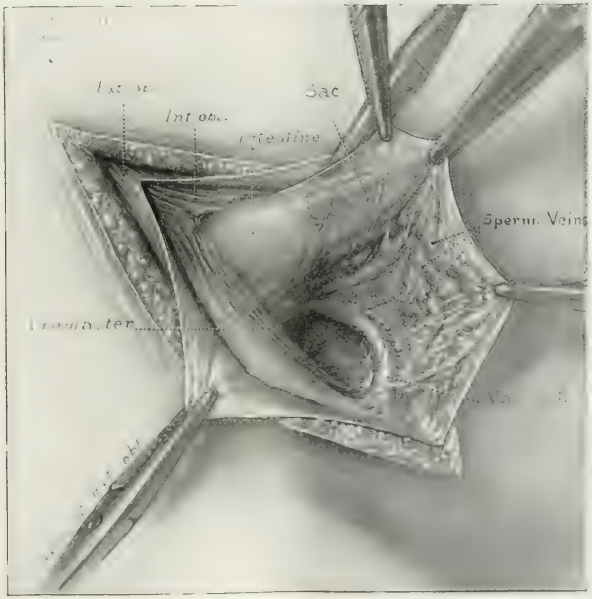


FIG. VI.

lis, and one or two others examined the man[1] with me. Even had I known what the result in this case was to be, I would have used, if possible, the internal oblique muscles in the old way, and hence have stitched the cremaster under rather than over the former. But the muscles were attenuated and not close at hand. Stitching the cremaster over the internal oblique muscle necessarily precludes the sewing of the latter to Poupart's ligament. The closure with the cremaster seems almost ideal in some cases; it is a method so inviting during the operation, and so true, when finished, to one of the *great principles of surgery; there is no tension.* It is, in this respect, as a plastic operation should be. What the ultimate verdict will be it is too soon to predict. The cremaster fibres, particularly the hypertrophied ones, will, in time, atrophy; but when this occurs, the cremasteric fascia, perhaps stronger than before, would probably remain, holding together the atrophied muscle bundles. There can, at least, no harm result from this attempt to strengthen the wall, for the internal oblique muscle has been used in the usual manner. The worst that could happen would be a recurrence, in a certain class of cases, at the lower angle, one that might, possibly, have been avoided if the aponeurosis over the rectus muscle had been employed instead of the cremaster as described by the author. The future will decide these nicer points, and it would seem that only the nicer points remain now to interest the operator.

Another feature of the present operation is to transplant the neck of the sac as described below. It is merely an additional precaution warranted by the good results obtained by Kocher and others with his operation.

And, finally, we overlap the aponeurosis of the external oblique muscle to insure the union which a mere approximation of the edges of the aponeurosis cannot do, and to close more snugly the external ring.

We still examine with the same care, but no longer with concern, the epididymis, testicle, stump of veins, etc., chiefly to ascertain if there is congestion (induration) of the epididymis or fluid in the tunica vaginalis. Often there is an appreciable, though very slight, induration of the epididymis, particularly if the veins have been ligated through the dense plexus very near the testicle; and often a few drops or a drachm or two, or even more fluid is present in the tunica vaginalis. This may become absorbed in a few weeks or months and might, when present, usually not be noticed by the patient except for the repeated careful examinations. Hydroceles containing several ounces have been recorded in our histories; in two or three instances operation for the cure of the hydrocele has been performed. What the proportion of hydroceles is to the cases operated upon for the cure of hernia, without vein excision, I cannot say for the reason that we excise the veins almost invariably nowadays, and in the days when the veins were not excised we did not observe our cases quite so keenly with reference to this point. One of the larger hydroceles followed, as I have said, an operation in which the veins were neither excised nor transplanted nor in any way disturbed. The patient, a navy officer, had an indirect rupture on each side. Both sides were operated upon at the same time and on both, hydroceles developed in a few days, although neither epididymis became more than just perceptibly indurated; but the larger hydrocele was on the side of the undisturbed veins and of the smaller hernia. Not a single atrophy of the testicle has been recorded since 1899, when Bloodgood published his report, and I believe that at that time it was noted that not one had been observed for several years.

Possibly some of my readers will ask, "Why take so much trouble, why make the operation so complicated when such good results as are published may be obtained by simpler methods?" The operation is not complicated for the surgeon competent to operate for the cure of hernia, nor are all its details required for the simpler cases, and we do not know just what the results obtained by simpler methods are. We cannot ascertain definitely even our own results, although we make a great effort and are admirably equipped to do so. This can be said, however, that, since the publication of the author's second paper, June, 1892, not a single recurrence has been charged to him. One of the world's most distinguished surgeons, the inventor of a clever hernia operation, made, with reference to himself, some such remark to the author three or four years ago, and the next morning two recurrences presented themselves. This surgeon permits his patients to get out of bed in eight days because, as he said to me, "A man can better afford to be operated upon three or four times for recurrence by my method than once by a method like McEwen's, which requires lying in bed for five or six weeks." In my experience a man would, *after* operation, prefer to spend several additional weeks in bed than run the risk of a recurrence. It is only before, not after the operation that a patient objects so vigorously to the time to be spent in bed.

The Operation.—The several steps of the operation are so well depicted by the illustrations of Brödel that a verbal description is almost superfluous for those who have the plates.

(I) The aponeurosis of the external oblique muscle is divided and the two flaps reflected as in the Bassini-Halsted operation.

(II) The cremaster muscle and fascia is split, not directly over the centre of the cord, but a little above it.

(III) The internal oblique muscle is made as free as possible. A little artefaction is here often necessary. If the muscle cannot be drawn, without tension, well down to Poupart's ligament, it helps, I think, to make a relaxation cut or two in the anterior sheath of the rectus muscle under the aponeurosis of the external oblique muscle. This sheath being in part the

[1] The history is briefly this. Male, æt. 59 years; Surgical No. 12,905; was operated upon January 15, 1902, for two very large scrotal ruptures, eighteen and twenty-four inches long (from external ring to bottom of scrotum). The conjoined tendons on both sides were almost obliterated. The circumcentral rings easily admitted four fingers. The cremaster muscles, very well developed, were used to close the entire dehiscence because the internal oblique muscles could, only with great tension, be drawn down to Poupart's ligament; the former was stitched in front of instead of behind the latter muscles. We had never before and have never since had occasion to use the cremasters in this way. Dr. Mitchell, my house surgeon, operated upon one side, and the author upon the other.

aponeurosis of the internal oblique muscle, one can readily comprehend that incisions into it, if properly made, might be of service. It is well, however, to postpone making such incisions until the sewing of the internal oblique muscle to Poupart's ligament is begun, for then the amount of tension can be nicely gauged and the number, length and precise position of the relaxation cuts determined. A second reason for postponing the relaxation incisions into the anterior sheath of the rectus muscle is that we sometimes use this portion of the rectus sheath to close the lower port of the inguinal canal, as already stated.

(IV) When the veins are large, and this is usually the case, they should be excised with very great care to avoid even the slightest extravasation of blood into the tissues about the smaller veins and about the vas deferens which they accompany. And the vas deferens, as first emphasized by Bloodgood, should not be raised from its bed or handled or even touched, lest thrombosis of its veins occur.[8] (Vide Fig. VI.) The veins should be ligated as high up in the abdomen as possible, being pulled down quite firmly just before the ligature (in a needle with the blunt end first) is passed between them. As a precaution against slipping, we apply two ligatures of fine silk, both for the abdominal stump and for the testicle stump of the veins. The farther from the testicle the veins are divided, the better, provided, of course, that their stump is external to the external abdominal ring.

(V) Ligation of the sac by transfixion or by purse string suture at the highest possible point. Both ends of this suture, after tying, are threaded on long curved needles, then carried far out under the internal oblique muscle from behind forwards, and, passing through this muscle, about 5 mm. apart, are tied. The idea was suggested to the author by Kocher's operation, the principle being essentially the same.[9]

(VI) The lower flap of the cremaster muscle and its fascia is drawn up under the mobilized internal oblique muscle and held in this position by very fine silk stitches, which, having engaged firmly a few bundles of the cremaster, perforate the internal oblique, preferably where it is becoming aponeurotic, and are tied on the external surface of the latter; vide Fig. I.

(VII) The internal oblique muscle, mobilized, and possibly further released by incising the anterior sheath of the rectus muscle, is stitched (the conjoined tendon also) to Poupart's ligament in the Bassini-Halsted manner. (Vide Fig. II.) Catgut is usually employed for this suture. The drawing was made from an unusually muscular subject and possibly exaggerated the size and extent of the internal oblique muscle, as well as of the cremaster, although the artist endeavored to record accurately what he saw.

[8] The fact is that the vas deferens is frequently accidentally handled or squeezed, but harm that we know of has never resulted since we have recognized the necessity for exercising great care in the separation and ligation of the veins.

[9] I have read recently in the Centralblatt für Chirurgie a reference to some other surgeon's account of this very procedure, but, unfortunately, cannot recall the surgeon's name and have not the facilities at this moment to hunt for it.

(VIII) The aponeurosis of the external oblique muscle is overlapped, as shown in Figs. III and IV. This is known as Andrew's[10] method, although devised independently by us.

(IX) The skin is closed with a buried continuous silver suture, and the incision covered with five or six layers of silver foil. It is unnecessary to dress or examine a wound closed in this manner for two weeks, when the wire may be withdrawn. Patients are kept in bed from eighteen to twenty-one days.

We hope to be able to publish very soon the results of the first 1000 operations performed for the cure of inguinal hernia at the Johns Hopkins Hospital. Certainly more than two-thirds of the operations have been performed by my associates, Drs. Finney, Bloodgood, Cushing, Mitchell and Follis, for we are all much interested in the subject. Each operator has been at perfect liberty and is encouraged to perform the operation according to his best judgment. This fortunately furnished a little variety, but of late the operation has, in almost every detail, been performed just as the writer has described it.

Inasmuch as only a limited number of surgeons see the Johns Hopkins Hospital Reports, in which Dr. Bloodgood published his article, it may be well to publish one or two of the Summaries which he prepared with such care and so great labor. He intends quite soon to investigate the condition of all those, so far as possible, who are included in these Summaries.

"Summary of the Ultimate Results. Complete to June 1, 1899."

"Recent cases, less than 6 months, and cases lost track of were not included.

All cases Group I to V healing p. p.	301 cases.	13 recur.	4.3%
All cases Group I suppurating	31 "	9 "	29%
Total	332 "	22 "	6.6%
Halsted's operation, Group I, healing p. p.	218 cases.	9 recur.	4.1%
Halsted's operation, Group I, suppurating	20 "	6 "	30%
Total, Group I	238 "	15 "	6.2%

"Recurrence in Wounds Healing Per Primam."

	Cases.	Recurrences.
(1) At the position of the transplanted cord, veins excised	109	nil.
(2) At the position of the transplanted cord, veins not excised	109	7 (6.4%)
(3) Upper angle of the wound, cord excised or not transplanted	83	1 (1.2%)

[10] The Chicago Medical Recorder, August, 1895, vol. ix, p. 67.

	Cases.	Recurrences.
(4) Lower angle of the wound, conjoined tendon wide and firm, rectus muscle not transplanted.....	264	nil.
(5) Lower angle of the wound, conjoined tendon obliterated, rectus muscle not transplanted.....	8	5 (62%)
(6) Lower angle of the wound, conjoined tendon obliterated, rectus muscle transplanted	14	nil.
(7) Lower angle of the wound, conjoined tendon wide and firm, rectus muscle transplanted	16	nil.

"Recurrence in Wounds Healing by Suppuration."

(1) At the position of the transplanted cord, veins excised	9	nil.
(2) At the position of the transplanted cord, veins not excised.....	11	4 (36.3%)
(3) Upper angle of the wound, cord excised or not transplanted.....	11	1 (9%)
(4) Lower angle of the wound, conjoined tendon wide and firm, rectus muscle not transplanted.....	27	2 (7.4%)
(5) Lower angle of the wound, conjoined tendon obliterated, rectus muscle not transplanted.....	4	2 (50%)

Dr. Bloodgood's "*Conclusions as to the operation for inguinal hernia,*" published in 1899:

"Our observations prove that Halsted's operation with the excision of the veins will give perfect results, except in those few cases in which the conjoined tendon is obliterated; in these cases our observations so far have demonstrated that the transplantation of the rectus muscle will give perfect results."

"If the veins could be excised in every case of inguinal hernia and the remainder of the cord transplanted without any risk of epididymitis and atrophy of the testicle, a perfect result would probably be accomplished in every case."

"The operation would then be: The ligation and excision of the veins, the transplantation of the remaining portion of the cord into the upper angle of the divided and transplanted internal oblique muscle, and, in cases in which the conjoined tendon is obliterated, the transplantation of the rectus muscle. So far we have not observed a single recurrence when these procedures have been adopted. The sole objection to this method is the danger of atrophy of the testicle after excision of the veins. Atrophy of the testicle has been observed only after a very marked epididymitis. The probabilities of this epididymitis are very much less when the veins are excised without disturbing the vas deferens and its immediate vessels. For this reason I should advise that when the veins are excised the remainder of the cord, a very small affair, be left undisturbed. I am very much inclined to believe that the cord, reduced to such a diminutive size by the excision of the veins, will be as little likely to be the cause of a recurrence in the lower angle of the wound as in the upper angle when it is transplanted."

"*Cases in which the Veins should not be Excised.*"

"When during the dissection of the sac the cord is torn from its bed in the inguinal canal and subjected to traumatism, and the testicle withdrawn from the scrotum, the veins should not be excised, because the probabilities of epididymitis and atrophy are too great. In such cases I would advise the transplantation of the veins alone, so that the larger cord is divided,[11] and the wound is weakened less by the presence of a very small cord in two places than by the presence of a larger cord in one place, which from our results we know to have been the cause of a recurrence in 6.4 per cent of the cases."

"Note, June, 1899. In October, 1898, I performed for the first time the splitting of the cord, transplanting the veins only. Since this date the modification has been followed in 26 operations for inguinal hernia. In 12 the rectus muscle was transplanted. The wounds in 25 cases healed per primam. In 19 cases no swelling of the testicle followed operation. In 7 cases there was slight but temporary swelling. Thrombosis of the veins was not observed in any of the 26 cases. It is seven months since the first two operations. Both are perfect results. The others are recent operations."

"When the bundle of veins is unusually large, and complete excision is contra-indicated for reasons already given, I have suggested that a portion should be ligated and excised and the remainder transplanted. This has been done in a recent case by Doctor Cushing."

"In children the veins should not be excised; the probability of atrophy is greater than in adults. As we have had no recurrences whether veins have been excised or not, it does not seem to make much difference what is done with the very small cord."

"In the female the round ligament and its vessels is such a small affair that it makes little difference what is done with it."

"References to the transplantation of the rectus muscle by Wöfler: Wöfler published his method of transplantation of the rectus in 1892 in the Beiträge z. Festschrift f. Th. Billroth. I did not see this publication until my colleague, Dr. Clark, returned from Germany, in June, 1898. My preliminary report had then just been published. For this reason no mention was made of Wöfler's work. In the Archiv für klinische Chirurgie, June, 1898, Dr. Slajmer publishes 150 operations after the Wöfler method. A careful reading of these two articles has convinced me that this method of transplantation of the rectus differs from mine. In the first place no special reasons are given for the transplanting of the rectus muscle, while in my publication the reason given for the transplantation of the rectus is to strengthen the lower por-

[11] The splitting of the cord has been discontinued by its author.

tion of the inguinal canal by the introduction of muscle which is weakened by the obliteration of the conjoined tendon. The description of the Wöfler method and the illustration on page 912 of the second article show that the rectus muscle is not transplanted in the best way to strengthen the lower portion of the wound, because the sheath of the rectus is not divided down to the symphysis pubis; but the division of the sheath ends at least 2 to 3 cm. above the pubic bone. For this reason the transplanted rectus muscle is approximated chiefly over the upper two-thirds of the wound. In addition, Wöfler divides the sheath of the rectus on the anterior surface above the linea semilunaris. In my method the sheath of the rectus is divided posteriorly and the belly of the muscle is brought out behind the internal oblique. I believe that by this method the muscle can better be transplanted so as to occupy the lower two-thirds of the wound. Slajmer reports 6 recurrences, about 6 per cent. In three of these cases the wound suppurated."

THE PATHOLOGY OF SMALLPOX.

By Wm. Royal Stokes, M. D.,

From the Laboratory of the State and City Board of Health and the Pathological Laboratory of the College of Physicians and Surgeons, Baltimore, Md.

A number of interesting changes have been noted in the various tissues and viscera of smallpox cases, and these changes are widely distributed throughout the system.

The pustular eruption is frequently found on the surface of the mucous membrane of the respiratory tract, and these often coalesce as ulcers, or masses of fibrinous inflammation.

These pustules and ulcers are often seen in the bronchi of the third and fourth order, and are quite frequent at the bifurcation of the bronchi. Necrosis of the surface epithelial cells is also very frequent, and fibrinous and purulent inflammation is also often present.

The lung often contains areas of broncho-pneumonia, and the liver, the kidney and the heart muscles show cloudy swelling and fatty degeneration. The heart muscle also often exhibits fragmentation of the fibres. The acute, soft splenic tumor of infection is usually present.

An interesting set of changes has been described by Weigert,[1] consisting in areas of local necroses in the liver, spleen, kidney and lymph glands. These areas consist of degenerated masses of coagulative necrosis containing much nuclear detritus, and many degenerated cells without nuclei.

The lesions of the bone-marrow first described by Chiari,[2] and called "osteomyelitis variolosa," are said to occur in 72 per cent of all cases. These small scattered nodules are about the size of a pea, and under the microscope they consist principally of epithelioid cells, which are probably produced from the normal marrow cells by proliferation. Leucocytes and traces of fibrin are also present, and the masses often undergo coagulative necrosis.

Chiari[2] examined the bone-marrow of 22 cases of smallpox in various stages with the following results: During the stage of simple early eruption, he investigated five cases, and found microscopic changes in three instances. Nine cases were observed in the pustular stage, of which eight gave positive results. Eight cases were examined in the stage of healing or scaling, and all gave positive results. In one of two cases who died from other causes about two months after recovery from smallpox, these necrotic masses were found.

The process is found especially in the yellow marrow of such bones as the femur, tibia, ribs, sternum, and the body of the vertebræ, and begins by a proliferation of the normal marrow cells. These form masses of cells, whose nuclei are surrounded by much cytoplasm. A few neutrophilic leucocytes are also found in these masses of epithelioid cells, and they soon show a central area of necrosis which often contains fibrin. He only demonstrated micrococci in one case as present in these necrotic masses.

Similar areas are frequently found in the testicle, and this condition is called "orchitis variolosa." In hemorrhagic smallpox the above changes are usually present in combination with local hemorrhages in the skin and various serous cavities.

Changes in the Skin.

The first change, according to Unna,[3] consists in an edema and swelling of the epithelium. Many of these cells undergo softening and colliquation, forming a cavity, while others remain as septa, dividing the cavity up into smaller loculi.

The epithelial cells undergo a special degeneration which is known as ballooning, and which affects all of the various layers, even penetrating into the hair follicles. These swollen cells often attain from two to three times their normal size. They sometimes retain their nuclei, but the cytoplasm becomes perfectly clear, and the nuclei are often fragmented. It is a variety of coagulative necrosis. Sometimes two or three nuclei are present in one cell.

The epithelial cells continue to undergo liquefaction, and this causes an increase in the size of the cavity, at the same time mitoses are found in the cells forming the circumference of the cavity. The cells become compressed, and undergo fibrinoid degeneration, forming strands in the cavity which give the reaction for fibrin.

Umbilication is explained by the fact that the degenera-

tion and edema of the epithelial cells take place more at the periphery of the vesicle. The less swollen centre remains behind. Unna does not believe that the cords of the compressed epithelial cells running through the vesicle act as guy ropes, but that the edema and compression is exerted more at the sides of the vesicle, and thus this portion of the lesion extends beyond the less compressed centre.

In the vesicular stage an exudation of serum takes place, and neutrophilic leucocytes also emigrate from the vessels into the vesicle forming the pus of the vesicle. These infiltrate the cutis, and also soon fill the vesicle, producing the pustular stage of the disease. This primary invasion of leucocytes is due to the smallpox poison, but often at the end of the first week there is a second leucocytic invasion, due to a secondary infection with the pyogenic cocci.

Healing.

As the pustule begins to dry, a scale or crust is formed, and the lesion is invaded by sprouting projections of newly-formed epithelial cells. The upper layers become horny, the lower layers form the other normal cellular layers. In order not to form a scar, the newly formed epithelial cells must grow in an even layer with the convex surface downward, and the stratum Malpighii must not have been destroyed by the process of degeneration.

Plasma Cells.

There is one change which should be mentioned in this connection, and that is the appearance of the plasma cells in the corium. It is held by many that the injury caused by the poison to the epithelial cells is the very first change which is apparent. Dr. Gilchrist, however, has kindly loaned me some sections made from very early papules, and although the epithelial cells show little or no change, the corium shows a marked infiltration with plasma cells. These are usually collected about small arteries and capillaries.

Dr. Gilchrist is of the opinion that this plasma-cell invasion is the earliest change to be noted in smallpox, and this opinion accords very well with the best conception of the method of infection.

It is inconceivable that the poison comes in contact with every portion of the skin at practically the same time, thus causing infection. It seems more rational to believe that the cause is inhaled, and that by means of the circulation it reaches the skin, where it causes widely distributed lesions.

The primary exudation of the plasma cells from vessels followed by the various epithelial lesions supports this theory.

Pathological Study.

The following pathological study was made from a series of five autopsies performed during the past year, and from sections and cultures in six non-fatal cases. Four of the cases were adults, and one case was that of a child 2 years old.

All of the cultures in the non-fatal cases were made from vesicles or early pustules, and in every case they remained sterile. Five sets of cultures were made from the autopsies, and in all of these cases the condition had advanced well into the pustular stage. Four cases gave a pure growth of Streptococcus pyogenes from the pustules, and one case of hemorrhagic smallpox showed the presence of Staphylococcus pyogenes aureus.

Various attempts were made to cultivate the specific cause of the disease. Material from bacteriologically sterile pustules was inoculated into eggs, on the surface of coagulated egg albumen, and in 1 per cent sterile milk, as this is said to be a good nutrient material for amebæ. All of the results were negative.

Pathological Changes in Smallpox.

In two of the five cases the respiratory tract was the seat of extensive changes. The inner surface of the larynx and trachea were both almost entirely covered with a dirty yellowish pseudomembrane. The under-surface of the epiglottis was also involved.

Histo-Pathology.

The primary condition consisted in an extensive degeneration of the lining epithelium. Often the limiting membrane of the nucleus was destroyed, and the chromatin was scattered as a fine dust through the cytoplasm, showing the condition known as nucleorhexis. Hyperchromatosis and irregularity in the size and shape of the nuclei also existed. These changes result in complete granular necrosis of the epithelium, and cause a necrotic layer without fibrinous deposits.

The submucous coat is often separated from the mucous coat by an exudation of fibrin and serum, and the former coat, together with the muscular coat, are richly infiltrated with plasma cells, small lymphocytes and cells resembling epithelioid cells. Even the cartilage cells show changes, consisting in the disappearance of the cytoplasm of the cell. The cell often forms an empty vacuole, with the nucleus forced to one side.

Streptococci in great numbers were stained in the masses of superficial necrotic cells, and in the vessels of the submucous coat.

Lungs.

The pleural surfaces of one case were dotted by vesicles about the size of a number six shot. These were very numerous, and on microscopic examination they seemed to be large lymph spaces distended with a serous fluid. One case showed a fibrinous pleurisy, and in three cases broncho-pneumonia existed.

In two of the cases the typical necrotic areas existed, which are so characteristic of smallpox. These consisted of a central area of coagulative necrosis containing numerous groups of streptococci. The necrotic centres were surrounded by a zone of cells, consisting of small lymphocytes, proliferated alveolar endothelial cells, and a few leucocytes. Both the necrotic area and the surrounding cells show masses of nuclear fragmentation, and many of the cells simply form a mass of granular debris. (See Fig. 19.)

The presence of actual bacteria in such large numbers in local necrotic areas is a departure from the usual rule, as in typhoid fever, eclampsia, diphtheria, and other diseases showing these changes, bacteria are not present necessarily, and the change is probably due to the toxin, or mechanical effects of cellular or fibrinous thrombi. Fig. 1 shows streptococci in an exudate in an air cell. Fig. 1 a shows the curious vesicles which were found on the pleural surface of both lungs in one of the cases of smallpox. At "a," two large distended clear spaces are seen, and "b" shows the normal lung tissue.

Heart Muscle.

In three cases the nuclei of the cardiac muscular fibres showed great irregularities in size, many being small and shriveled. Others were enlarged, irregular, oval or round, and stained more lightly than normal. In one case there was evidence of longitudinal splitting of the fibres, on cross section a central channel, containing radiating smaller connecting lines resembling a fine tooth comb, being present.

The Liver.

The livers in all cases were enlarged and yellowish, but very little fatty change was found microscopically. Cloudy swelling, the accompaniment of all acute infections, was always present. Under the microscope the enlargement was found to be due to congestion and cloudy swelling, and no fatty areas were seen. In one case a few collections of proliferated endothelial cells and small lymphocytes were present without actual general necrosis, and in another case necrotic areas, somewhat similar to those described in the lung, were detected. These two different varieties of necrosis of the liver correspond to those described by Councilman [4] and Mallory in their studies of the liver in diphtheria. The first variety they called disseminated necrosis, and these usually only consist of a collection of cells of various types. The liver cells present are necrotic and broken down, and the nuclei show various stages of degeneration.

Among the necrotic liver cells a few proliferated endothelial cells and leucocytes are usually found.

Although these changes were only made out in the liver of one of the five cases, the degeneration of the liver cells and the proliferation of the endothelial cells could be made out in these small areas, which in this particular case usually consisted of about twenty-five cells.

In one case, that of a child two years old, the so-called central necroses of Councilman and Mallory were detected in the liver. These usually occur near the central vein in diphtheria, but in one case of smallpox they were found in connection with the portal systems, and even in the middle of the lobules. They simply consisted of large collections of broken down necrotic masses of a homogeneous material resulting from the destruction of liver cells. These areas took on a brilliant red stain when treated with methylene blue and eosin. The necrotic areas are marked by large collections of nuclear detritus, and the destruction of liver cells can be well made out on the edge of the areas. The protoplasm of the cells coalesces into homogeneous masses, and in the early stages of destruction the chromatin of the nucleus breaks up into large irregular fragments, which are scattered through the cytoplasm of the cells. This was in a case of general streptococcus infection, but streptococci did not seem to play any important part in the production of these areas as particulate bodies. A few streptococci were found on the edge of these areas, but they were not detected in the middle of the necrotic material. Throughout the rest of the liver large groups of streptococci were found in the capillaries and spaces between the endothelial cells and liver cells. It would seem, therefore, that excluding the cause of smallpox, that these areas are caused by the soluble products of the secondary invader, the Streptococcus pyogenes.

Fig. 2 shows a typical area of central necrosis. At "a" the normal liver structure is seen, while "b" shows the outer zone of necrosis in which many liver cells can be made out in various stages of degeneration. Remains of the protoplasm and nucleus can still be made out. At "c" the central zone of complete structureless necrosis with intense nuclear fragmentation can be made out.

Microscopic Examination of the Kidney.

Extensive changes were found in every kidney examined.

In one case, in a child 2 years old, the acute interstitial nephritis, described by Councilman [5] in cases of scarlet fever and diphtheria, was found. The kidneys were enlarged, and the tubules were separated from each other by cellular infiltration. This infiltration also often surrounded the glomeruli outside of the capsule. These cells are not leucocytes, but are much larger, and the nucleus stains very deeply and is usually placed eccentrically at either end of the cell. Councilman believes that in some way these cells are derived from the small blood vessels, as they are often found within these vessels. He also thinks that their irregular shapes indicate that they are ameboid, and he identifies them as Unna's plasma cells. According to him they are large lymphocytes, and they emigrate from the vessels in acute interstitial inflammation of the kidney. They are very numerous in the spleen and bone marrow, and are probably found principally in these situations.

In one very malignant confluent case the kidney was the seat of most interesting lesions.

On looking at some of the glomeruli, with the low power, they seem partially changed into hyaline masses, and the high power shows that this condition is due to numerous large or small droplets of a clear hyaline material within the lumen of the capillaries. This condition is apparently due to an actual degeneration of the endothelial cells of the glomerular capillaries, since many of these can be seen in the various stages of degeneration. The nuclei seem to swell and take up a much paler stain than normal, and the cytoplasm breaks up into round hyaline droplets of various sizes, which often coalesce into large confluent drops, apparently obstructing and distending the capillary lumen.

Sometimes the chromatin of degenerating endothelial cells becomes increased in amount and granular.

The epithelial cells lining the capsular space also frequently proliferate, which compresses the capillary network into an irregular mass. They can be distinguished from the endothelial cells of the capillaries by their larger vesicular more lightly staining nuclei, and by the greater amount of eosin-staining cytoplasm. These proliferating capsular endothelial cells show a great tendency towards hyaline degeneration, which seems to begin by an increase in size of the nucleus, while the cytoplasm turns to round hyaline drops of various sizes. The nucleus takes on a paler stain with hæmatoxylin, and finally disappears in the hyaline material, which becomes confluent, forming large round or oval drops.

Sometimes the hyaline material forms a large crescentic mass of homogeneous clear material in the capsular space.

The epithelium of the convoluted tubules is swollen, and the cytoplasm of the cells contains numerous granules. Many of the cells, however, have undergone a much greater change. The cytoplasm is completely transformed into a mass of clear droplets of about the average size of from three to ten times the diameter of a micrococcus. The nuclei are usually well preserved, although the cells are often swollen to about twice their natural size, and simply consist of a mass of granules. These degenerated cells finally break up and the granules become free in the lumen of the tubule. Here they seem to coalesce into hyaline casts. The limbs of Henle are often distended and filled by casts of clear hyaline material. These areas of degeneration do not stain by Van Gieson's stain, and are therefore not true hyaline. When stained by Weigert's fibrin stain, however, both the clear droplets and the casts take up a deep purple stain. This is the reaction for fibrin, and the degeneration must be of a fibrinoid character. The formation of the hyaline casts from the degenerated cells can also be clearly made out, as many purple droplets are seen gradually coalescing to form casts taking the same stain. This is of interest concerning the somewhat doubtful origin of hyaline casts, and it would seem clear that in this instance they were formed from degenerated cells of the tubules undergoing fibrinous change. The formation of casts from somewhat similar large droplets has been described by Councilman and Mallory in diphtheria. These large droplets in the degenerated tubular epithelium of the cortex stain a deep blue color by Mallory's connective tissue stain, and the hyaline casts present stained also blue by this stain. Councilman and Mallory think that both the hyaline and granular casts are formed from these products of cell destruction.

When these degenerated cells are stained by osmic acid, and then counterstained by safronin, eosin or other stains, many of the smaller granules take up the black fat stain, but many remain colored by the safronin or eosin.

There are therefore fatty and fibrinous changes side by side in the same cell.

Fig. 3 shows streptococci in the liver.

Fig. 4 shows acute interstitial nephritis. In the centre of the photograph at "a," there is an atrophied, compressed glomerulus completely surrounded by the cellular exudation of plasma cells. This exudation also separates many of the convoluted tubules from each other.

Fig. 5 shows the degeneration of the epithelial cells of the tubules very well. The specimen was first stained by eosin, and then by Weigert's fibrin stain, and the cytoplasm is broken up into the large granules seen in the picture. These granules usually take up a deep blue stain by this method, thus giving the reaction for fibrin. The tubule marked "a" shows this degeneration, and at "b" a degenerated cell can be seen whose nucleus is still present. At "c" the tubule contains many desquamated, degenerated cells free in the lumen. Many of these cells have lost their nuclei, and some of them show the granules mentioned above. Fig. 6 shows a similar condition, and at "a" the tubule contains a granular cast which in the stained Weigert specimen takes up a light blue stain. It seems that these granules gradually coalesce into casts of a hyaline or granular nature.

Changes in the Spleen and Other Viscera.

The spleen was large and soft in two cases, and of normal size and consistency in three instances. Microscopically, nothing was found except acute congestion of the splenic spaces. The stomach, small intestines, large intestines, bladder, diaphragm, voluntary muscles, and pancreas were normal in those cases examined. The granular layer of the medulla of the adrenal gland in one case contained areas of cellular infiltration without necrosis. These consisted of small lymphocytes and cells of an endothelial type.

Lesions in the Skin.

No lesions of the skin were noted which have not been previously described, but the primary exudation of plasma cells has not been especially emphasized in Unna's description. These plasma cells are probably derived in part by proliferation from the endothelium of the lymph spaces and lymph vessels.

In some of the sections made from very early cases, the epithelial cells do not show any great injury, but the cutis is swollen, and there is an increased number of plasma cells in the lymph spaces, and around the small blood vessels. The condition resembles the response to some injury, and seems to be the first change in the skin, since the various changes in the epithelial cells are not yet present. Some of these cells have an eccentric nucleus, and resemble the cells found by Councilman in the hyperplastic bone marrow in diphtheria. Other cells in these groups exactly resemble the endothelium of small vessels, and are probably derived from lymph spaces and small vessels by proliferation. The typical plasma cells are thought by Councilman to be emigrated large lymphocytes.

Fig. 7 shows the primary cellular infiltration which seems to precede the injury to the epithelial cells. At "a" can be seen a normal layer of epidermis, and beneath this in the corium at "b" there is a large collection of the so-called plasma cells. Smaller groups are scattered through the cor-

ium at other points, and since the epithelial cells show no injury, this cellular infiltration seems to represent the primary lesion of the skin.

The next change in the earliest lesions was edema and swelling of the epithelial cells, followed by contraction of the nucleus. This often became fragmented and broken up into small granular masses. The exudation of leucocytes and serum, and the liquefaction of the epithelial cells was also observed.

The various changes in the epithelial cells are well shown in the photomicrographs. Fig. 8 begins a series showing the injury to the epithelial cells, and would correspond to the early papular stage of the eruption. At "a" various stages of nuclear atrophy and fragmentation can be made out, and at "b" the great edema and liquefaction of the cytoplasm of cells appears. This is the ballooning process of Unna. The process begins in the stratum lucidum and stratum granulosum. Fig. 9 simply shows a continuation of the same process. Fig. 10 shows a curious degeneration of the epithelial cells of the stratum granulosum. The nuclei are shriveled and the surrounding cytoplasm is broken up into circular clear masses resembling fat drops. At "a" the phantom-like outline of these globular, clear masses can be well made out, and this degeneration seems to be a further process in the formation of the vesicle. Fig. 11 shows a vesicle originally filled with a clear fluid. At "a," the junction of the stratum lucidum and the stratum granulosum, the layer of epidermis has split, and the layers pass above and below the fluid contents of the vesicle. Several hair follicles are seen at "b," and "c" shows that the corium is free from any participation in the vesicle. Fig. 12 shows a smallpox pustule, which has ruptured the lower enveloping layer of epidermal cells. Many neutrophilic cells have thus escaped, and have infiltrated the corium. Such accidents account for the scar formation following smallpox, or the so-called pitting, since the scar must form when fibrous tissue regenerates after inflammation. "A" shows the pustule which has ruptured at "b," and "c" indicates the corium richly infiltrated with neutrophilic leucocytes, and an edematous albuminous fluid. Fig. 13 is taken from a section made directly through the area of umbilication in a pustule. It shows very well that the umbilication is simply produced by an edema and purulent infiltration of the sides of pustule, causing a bulging, while the central portion of the pustule, which shows little edema, remains as a depressed centre. At "a" the layers of epidermis are separated by a purulent edematous fluid, and at "b" the exudation is entirely purulent. The central or depressed area of umbilication at "c" shows very little change, and at "d" the lower layer of epidermis has not ruptured, showing a normal subcutaneous layer at "e." The crater-like depression of umbilication is well shown. Fig. 14 shows a mass of interlacing filaments of fibrin, including pus cells within the meshwork. This exudation of fibrin is often seen in smallpox pustules, especially when there is a mixed streptococcus infection. At "a" the network of fibrin is seen ending abruptly at "b," the corium.

In early cases of smallpox a clear space forms around the nucleus, and this gives an appearance of a shrunken body inclosed in a clear capsule.

In the hemorrhagic case, the cells of the stratum granulosum showed various stages of nuclear degeneration, and the edema of the cytoplasm with typical ballooning was observed. The capillaries and lymph spaces of the corium were greatly distended by red blood corpuscles, and numerous hemorrhages were present in the connective tissue. The epidermis was not invaded by red blood corpuscles.

Changes in the Testicle.

Necrotic changes were noted in the testicle in two cases, and the various stages could be well traced out. The process seemed to begin by a necrosis of the epithelial cells of the seminiferous tubules. The nuclei of these cells showed marked karyorrhexis, and the protoplasm of the many cells was necrotic and granular. In the later stages, large areas of necrosis can be seen to particularly consist of seminiferous tubules which have coalesced into masses with central areas of coagulative necrosis, with nuclear fragmentation, surrounded by a thick zone of necrotic cells. The intertubular connective tissue is thickened, and even the walls of the arteries have undergone necrosis with nuclear fragmentation.

Fig. 15 is a good representation of the necrotic areas found in the testicle. At "a" a few normal seminiferous tubules are present, which at "b" are gradually undergoing necrosis, with loss of contour. The area marked "c" consists of a necrotic mass of coagulative necrosis with much nuclear fragmentation. Fig. 16 at "a" shows the seminiferous tubules under a higher power, and many of the epithelial cells show fragmentation or loss of their nuclei. The gradual transition of these injured tubules into necrotic material is also well shown.

Secondary Bacterial Infection.

This is a point of general importance, as the rapid advance of serum therapy towards a remedy for combating septicemia bears directly upon this matter.

It is now well known that many typhoid cases, and perhaps the majority of the eruptive fevers, die not so much from the primary cause, as from secondary infection with Streptococcus pyogenes.

This streptococcus infection is the most striking feature of fatal smallpox, and the course of infection can be traced from the skin to the general circulation.

As mentioned above, the cultures from vesicles in early and mild cases of smallpox remained sterile, but after the secondary fever the pustules often contain streptococci in abundance.

Four of our fatal cases after death contained streptococci in the pustules, and in the various viscera, such as the heart, liver, kidney, spleen, lymph glands, pancreas and lung.

On staining by Weigert's stain for bacteria, streptococci could be demonstrated in the pustules of the skin, and in the lymph spaces of the corium.

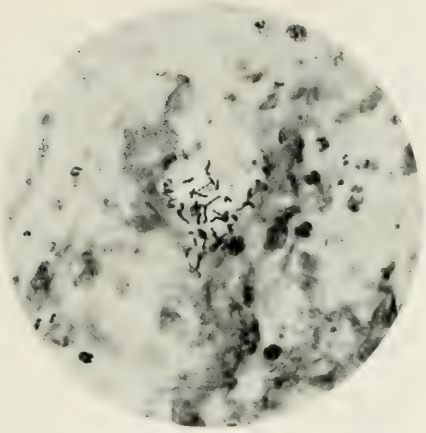


Fig. 1. Section of lung of smallpox case showing a purulent exudation in an air cell containing streptococci.—*Dr. C. H. Potter.*

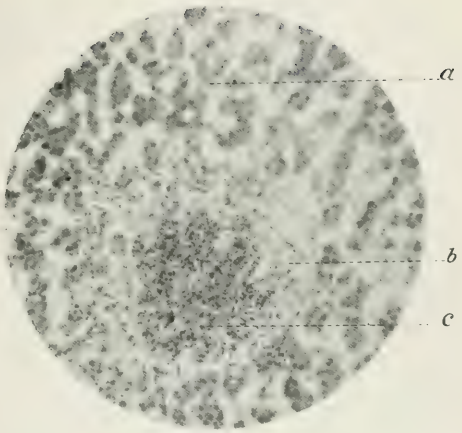


Fig. 2. Section of liver showing a typical area of central necrosis. The zone at "a" shows the rows of liver cells separated by capillaries, and "b" shows the outer area of necrotic liver cells in various stages of destruction. At "c" the complete structureless zone of necrosis can be made out.—*Dr. C. H. Potter.*

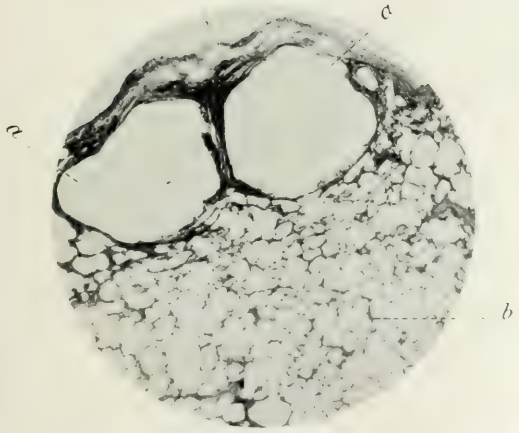


Fig. 1 a. Section of lung and pleural surface showing large spaces on the pleural surface filled originally with fluid. These pseudo-vesicles of the pleura are shown at "a," and "b" indicates the normal lung tissue.—*Dr. C. H. Potter.*

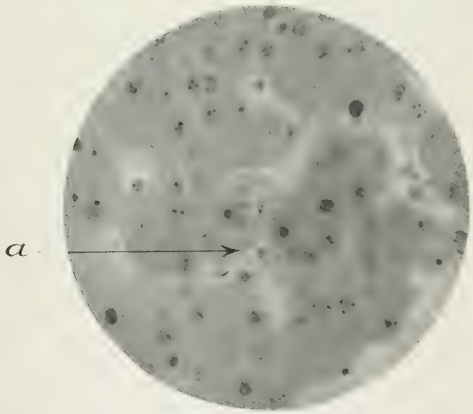


Fig. 3. Section of the liver showing a few streptococci at "a" in the capillary spaces of the lobule. *Dr. J. S. Fulton.*

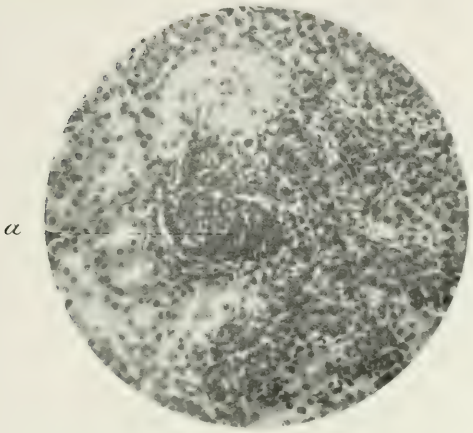


Fig. 4. Section of kidney showing acute interstitial nephritis under a higher power. At "a" a large group of plasma cells are seen surrounding a glomerulus and separating several tubules from each other.—*Dr. C. H. Potter.*

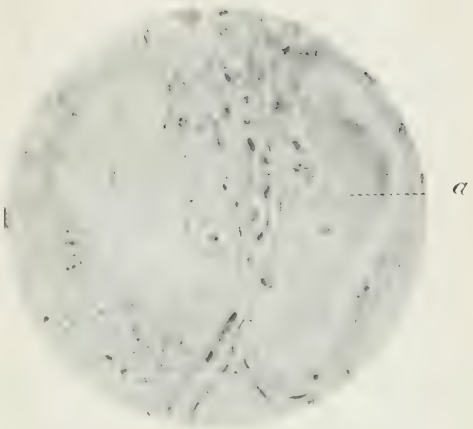


Fig. 6. Section of the cortex of the kidney showing the same degeneration as Fig. 5. At "a" a cast which stained by the fibrin stain is seen, showing the formation of the casts from these granular bodies.—*Dr. C. H. Potter.*

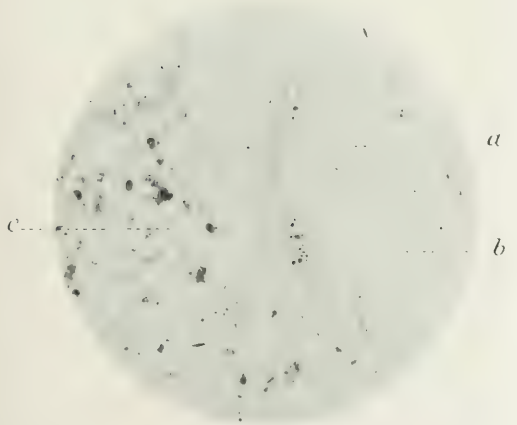


Fig. 5. Section of kidney showing the special fibrinous degeneration of the epithelium of the convoluted tubules. "A" indicates the granules in the degenerated cells staining by Weigert's method, and at "b" a cell almost entirely degenerated is seen. At "c" a number of degenerated epithelial cells in the lumen of a tubule can be seen, and many of these cells contain these granules.—*Dr. C. H. Potter.*

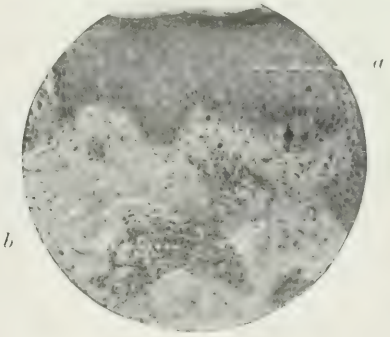


Fig. 7. Section of the skin showing the primary infiltration of the corium by the plasma cells. This is shown at "b", and "a" demonstrates that the epithelium is not yet injured.—*Dr. J. S. Fulton.*

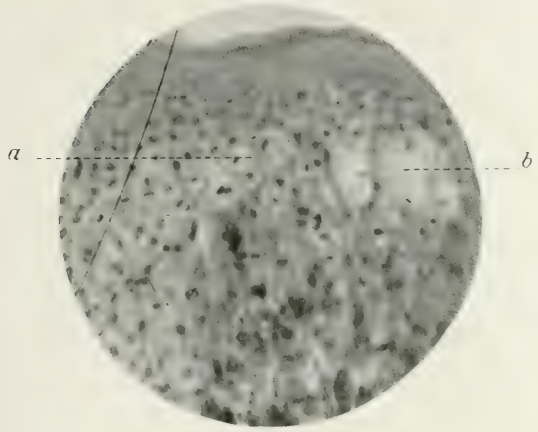


Fig. 8. Section through the epidermis in the papular stage. At "a" various stages of nuclear atrophy and fragmentation are seen, and at "b" the great edema and liquefaction of the cytoplasm of the cells can be made out. This is an example of the earliest epidermal changes in smallpox. The change in the cells at "b" is called the ballooning process, owing to the distended condition of the swollen cells.—*Dr. C. H. Potter.*

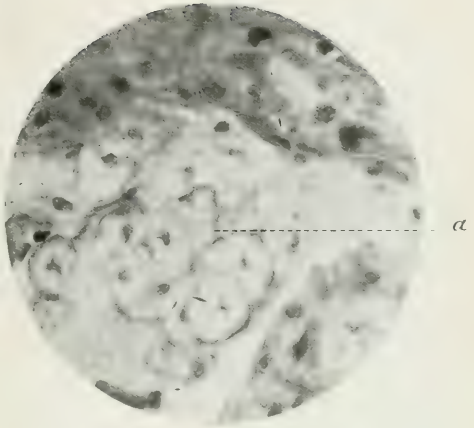


Fig. 10. Section through the epidermis showing a curious degeneration of the cells. The nuclei are shriveled, and the cytoplasm surrounding the nuclei is broken up into circular masses like fat drops. At "a," the phantom outline of these globular masses can be seen, while in the upper part of the picture the epithelium shows normal nuclei and cytoplasm.—*Dr. C. H. Potter.*

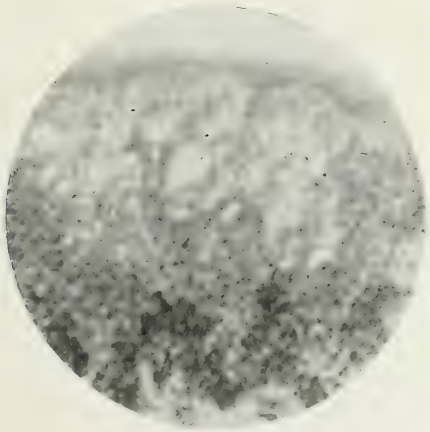


Fig. 9. Section through the epidermis. This shows a continuation of the process described in Figure 8. The various layers of the epidermis are shown in various stages of degeneration, and some of the cells are swollen to about three times their normal size, and the granular cytoplasm is replaced by a clear fluid. Some of the nuclei are present, but many of the epithelial cells have lost their nuclei. This is the stage which precedes the vesicular stage.—*Dr. C. H. Potter.*

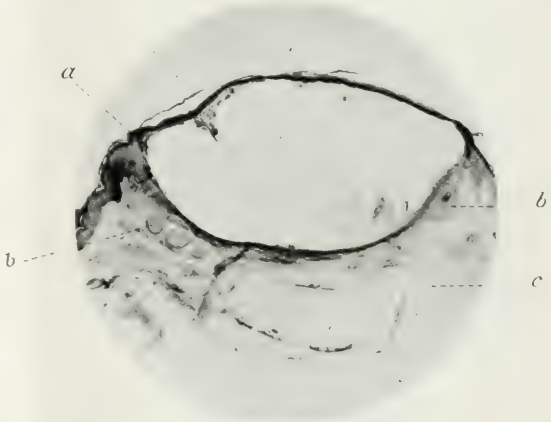


Fig. 11. Section through the skin showing a vesicle originally filled with a clear fluid. At "a," the junction of the stratum lucidum and the stratum granulosum, the layer of epidermis has split, and the layers pass above and below the fluid contents of the vesicle. This thin layer is unruptured, and the corium at "c" shows no infiltration. At "b" several hair follicles are seen.—*Dr. C. H. Potter.*

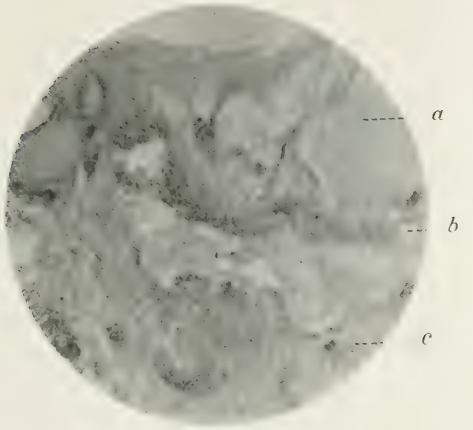


Fig. 12. Section of a pustule which has ruptured at "b," where the break in the rete Malpighii can be seen. "A" shows the pustular contents of the pustule, and "c" indicates the intense purulent infiltration of the corium. This explains the pitting, as in these cases the scar must always follow the inflammation of connective tissue, while the unruptured pustule will regenerate its epithelium without scar formation. The adjacent normal epithelium can be seen at the upper portion of the picture.—*Dr. C. H. Potter.*

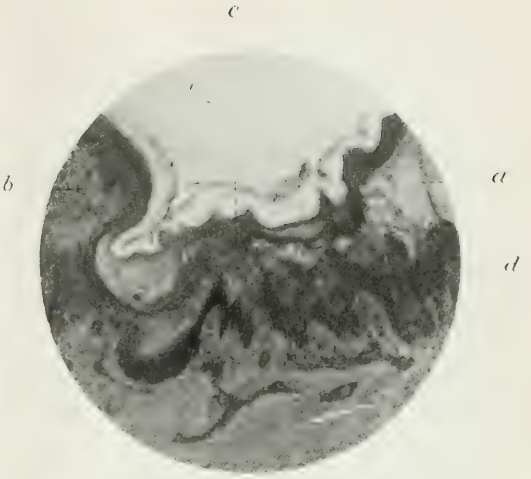


Fig. 13. Section through the central portion of a pustule showing the phenomenon of umbilication. The crater-like depression is seen at "c," and below this the various layers of the epidermis show very little swelling, edema or other changes. The edema and purulent infiltration to either side can be well seen. At "a" the layers of epidermis are separated by a sero-purulent fluid, and at "b" the exudation is entirely purulent. At "d" the lower layer of the epidermis is unruptured, and the corium shows no infiltration. This section shows the reason for umbilication very well.—*Dr. C. H. Potter.*



Fig. 14. Section at the base of a pustule just adjacent to the corium. This shows the fibrinous network, including pus cells often seen in pustules. At "a" this network is shown, and "b" shows corium infiltrated by plasma cells. At the lower portion of the section a small vessel surrounded by plasma cells is seen.—*Dr. C. H. Potter.*

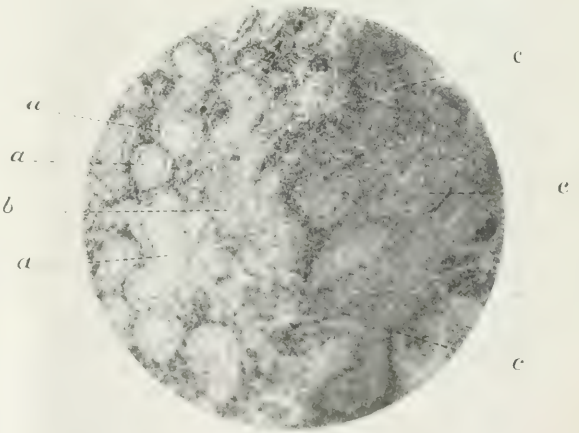


Fig. 15. Section of testicle showing the necrotic areas. "A" indicates the fairly normal seminiferous tubules, "b" the tubules undergoing necrosis and destruction, and "c" shows the completely necrotic zone with intense nuclear fragmentation.—*Dr. C. H. Potter.*

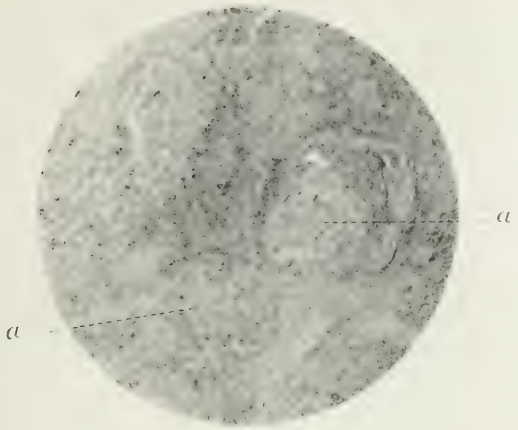


Fig. 16. Section of testicle under a high power, showing at "a" the remains of tubules which have undergone partial necrosis. Their outline as tubules can still be made out, but their gradual transition into necrotic material can be well seen.—*Dr. C. H. Potter.*



Fig. 18. Section of lymphatic gland showing at "a" a thrombus consisting of a fine reticulum of fibrin in a lymphatic vessel. The normal lymphocytes are well shown.—*Dr. J. S. Fulton.*

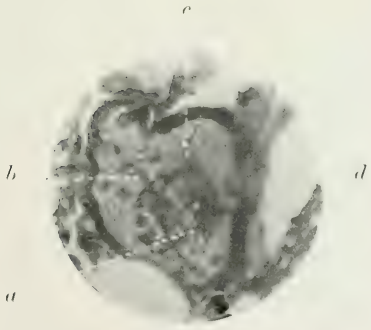


Fig. 17. Section of lung showing the beginning of thrombosis in a blood vessel. The strands of fibrin are well shown at "a," and "b" shows a few leucocytes. "C" shows a mass of red blood corpuscles, and "d" shows a clear air vesicle.—*Dr. J. S. Fulton.*

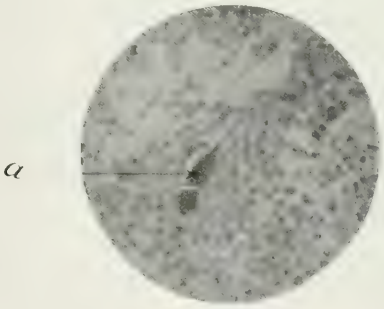


Fig. 21. Section of a lymphatic gland showing an embolus of micrococci in a small vein at "a."—*Dr. J. S. Fulton.*

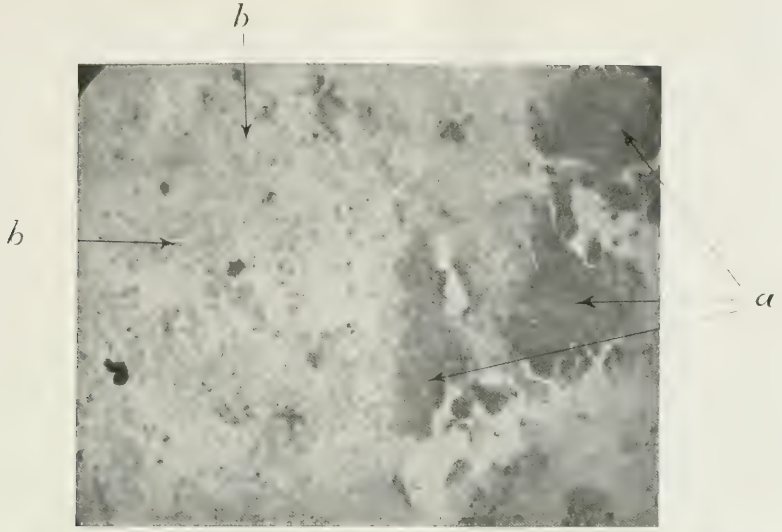


Fig. 19. Section of a mass of necrosis in the lung. The enormous masses of bacteria are well shown at "a," while "b" shows the necrotic material containing many necrotic cells.—*Dr. J. S. Fulton.*

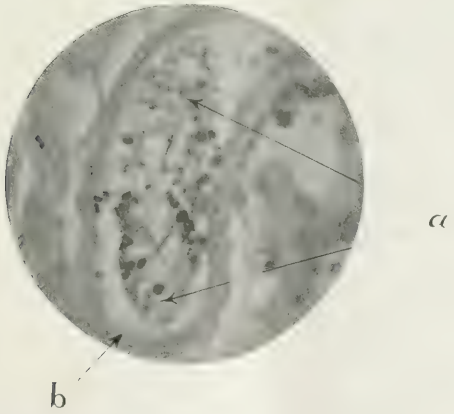


Fig. 20. Section of the testicle showing a vein containing a thrombus. At "a" many strands of fibrin are to be seen, while "b" indicates the wall of the vein.—*Dr. J. S. Fulton.*

From this point they are carried to the lymphatic glands by the lymph current, and stained sections from the cervical and bronchial glands gave a remarkable picture.

In the cortex of the glands, usually just beneath the capsule, there were extensive focal necroses. The lymph-sinuses were greatly distended, and the necrotic areas often contained neutrophilic leucocytes. When these glands are stained by Weigert's method, many of the necrotic areas are seen to consist almost entirely of masses of streptococci. There are also many streptococci in the lymph sinuses of the glands. The arteries and capillaries also contain streptococci, and there are fibrinous thrombi in many of the lymph channels of smaller glands. This condition was found in the cervical and bronchial glands, showing the absorption of the streptococci from the pustules of the skin, and the diseased mucous membrane of the bronchus.

It has been a disputed point as to whether the secondary infection with the streptococcus originates from the pustules of the skin or from the necrotic mucous membrane of the respiratory tract. It seems likely that both of these may be sources of infection.

In one of the cases, the mucous membrane of the epiglottis, larynx and trachea was the seat of a dirty gray membrane, which contained numerous streptococci in the necrotic surface layer when stained by Weigert's method. The lung itself was normal. The pustules on the skin contained a few diplococci, and the corium contained emboli of streptococci. This was a case of profound streptococcic infection in which large masses of organisms were found (see Fig. 21) in the cervical lymph glands, the kidneys, the liver, and the thymus gland. The tremendous masses of streptococci in the respiratory tract suggest this as the main atrium of infection. The organisms may also have entered the circulation from the skin, but they were so few in number as compared even to the viscera, that the skin may have simply been a secondary repository for the organisms brought originally from the respiratory tract.

In another case the streptococci undoubtedly came from the respiratory tract and the lung tissue. The trachea contained a membrane, the bronchi contained much pus, and there was a fibrinous pleurisy and broncho-pneumonia with many necrotic areas in the lungs (see necrotic areas in lung with organisms in Fig. 19). In all of these situations there were numerous streptococci, but neither the pustules on the skin nor the lymph spaces of the corium contained organisms. The viscera contained many streptococci.

In a third case the respiratory tract and lungs were normal, but the pustules on the skin, and the lymph spaces in the corium contained large groups of streptococci. This was a pronounced case of general infection with emboli of streptococci in the viscera, and these organisms undoubtedly entered the general circulation from the pustules.

These organisms then enter the general circulation, causing general septicemia, and bacteria were demonstrated in stained sections from the kidney, liver, lung, testicle, spleen and thymus gland. The bacteria were in the necrotic areas of the lung, the capillaries and the alveolar exudates, and also in the intertubular capillaries of the kidney, the lymph spaces of the portal system, the capillaries of the liver, the perivascular lymph spaces of the lung, the necrotic epithelium of the bronchi, and the veins and lymph spaces of the thymus gland, which also contained thrombi. The presence of the pyogenic bacteria in the skin and lymphatic glands has already been mentioned.

Ewing[6] found streptococci in the heart's blood in 29 cases of smallpox, and Arnaud[7] obtained this organism in two cases from the blood of the heart during life.

Tendency Towards General Thrombosis.

Many of the viscera contain fibrinous thrombi in the small veins and lymphatics, and these lesions are usually very pronounced in the blood vessels of the lung, spleen, testicles, thymus glands and lymphatic glands. Large masses of fibrin are very frequent in the vessels of these viscera, and Fig. 17 shows the beginning of fibrin formation and thrombosis in a blood vessel of the lung. The strands of fibrin are well shown at "a," and at "b" lymphocytes and neutrophilic leucocytes are to be observed. "C" shows the mass of red blood corpuscles and "d" the open spaces of surrounding air cells. Fig. 18 is a photograph of a lymphatic gland, and at "a" the fine network of a fibrinous thrombus of a lymphatic vessel can be seen. Fig. 19 shows a collection of short chains of streptococci into masses, and represents a very frequent picture in smallpox sections. The large masses of organisms found in various viscera are often startling, and they might almost be described as emboli of microorganisms. The photomicrograph was made from an area of necrosis in the lung, and shows the micrococci collecting into masses resembling the agglutination of other organisms.

At "a" large groups of micrococci can be seen, and in the centre of the picture a number of individual micrococci can be distinguished. At "b" the various stages of coagulative necrosis with fragmentation of nuclei and granular destruction of the cytoplasm of cells resulting in homogeneous masses of necrotic material can be observed.

In many of the thrombi groups of streptococci can be stained, and these organisms probably injure the endothelium of the vessels, and thrombosis results. Fig. 120 shows a thrombus in a vein of the testicle, but no organisms were present in this section. The rather coarse fibrin filaments including red blood corpuscles in their mesh-work are indicated at "a" and the wall of the vein is seen at "b." "C" shows a few cells of the seminiferous tubules.

The liver is one of the favorite seats for the presence of streptococci in smallpox, and Fig. 3 shows a number of organisms in the capillaries of the liver between the rows of liver cells. The streptococci can be well seen at "a."

In some of the smaller capillaries of the testicle there are many large droplets which take up a fibrin stain. They almost resemble small hyaline casts.

SUMMARY.

Although we have only studied five cases of smallpox at autopsy, yet some conclusions can be drawn from the work.

The early skin lesions indicate that the primary infection in smallpox takes place in the lungs, probably by inhalation. The poison, when it enters the circulation, shows a selective influence on the epithelium of the skin and respiratory tract, and many cases are probably not further affected.

The serious and fatal lesions of smallpox are caused by the secondary infection from the skin and respiratory tract, and the infectious agent is usually the Streptococcus pyogenes. This organism is so distributed throughout the lesions as to explain most of the visceral changes, such as thrombosis, local necrosis, and the various pulmonary changes.

This streptococcic septicemia is the most striking feature of fatal smallpox, and if it were possible to overcome this condition by a special serum, the mortality from the disease would be greatly reduced.

In conclusion I desire to thank Dr. Caleb Rohrer for assistance in the autopsies, and to acknowledge the many courtesies received from Dr. S. O. Heiskell, Assistant Commissioner of Health at Quarantine.

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METHOD OF INSTRUCTION IN SURGICAL PATHOLOGY.

ABSTRACT OF PAPER READ BEFORE THE AMERICAN SURGICAL ASSOCIATION IN WASHINGTON, MAY 4, 1903.

BY J. C. BLOODGOOD, M. D., *Baltimore,*

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Clinical instruction in the out-patient department and in the hospital wards has and will always have certain defects and limitations as a complete method of instruction.

The question to be solved is: Can these limitations and defects be removed?

The method of instruction in the surgical pathological laboratory of the Johns Hopkins Hospital has reached a sufficiently satisfactory development to justify its presentation at least as a possible solution of the problem of teaching surgery.

Clinical instruction in the out-patient department and in the wards must to a very large extent be limited to the observation of the patients treated. The usual period of time spent by a student in the hospital dispensary and wards is two years. During this time many important surgical diseases may not be seen at all or so seldom that the student does not get a clear or lasting clinical picture of these rarer forms of disease. Of necessity examples of the various surgical diseases present themselves in no systematic order, and are so scattered that the student seldom, if ever, can observe in the dispensary or even in the ward at the same time the different varieties of affections of a single organ or part. Even in the ward it is very difficult to arrange that the student follow the patient from his admission through the operation and after-treatment and to present to him the diagnosis confirmed in the pathological laboratory with the result of the treatment when the patient leaves the hospital; the ultimate result many years afterwards can never be presented. Although the time between the admission and discharge of the patient is frequently an interval of a few weeks only, nevertheless it is a difficult problem to keep all the students of a group familiar with even the important details in the history of each patient.

These limitations and defects can be remedied to a very large degree by the method of instruction which has been adopted in the surgical pathological laboratory of the Johns Hopkins University.

We may describe this method briefly as follows:

The instruction given to the third year medical class in the surgical laboratory is divided into two parts. The first may be called the systematic instruction which is given by pamphlets, museum specimens, microscopic sections and illustrations. The second part may be called routine instruction, which is limited to the fresh material, sent to the laboratory from the operating or the autopsy rooms.

First Part.—For systematic work the third-year student at the beginning of the year comes to the laboratory one

afternoon each week. The class is divided into groups of not less than five and not more than ten. Each group is given a pamphlet and a box of microscopic slides stained and labeled. Near each group on a table, a rolling table if possible, are placed the museum specimens discussed in the special pamphlet given to this group. The pamphlet corresponds somewhat to a chapter in a text-book on surgery. It may have, for examples, titles like these: "Tumors and Inflammations of the Breast," "Malignant Tumors of Bone," "Inflammations and Tumors of the Thyroid," etc., and each pamphlet discusses the various affections of a special organ or part. In the first part of the pamphlet entitled "Tumors and Inflammations of the Breast," for example, the student is given the number of cases treated during the life of the clinic, in relation to the total number of surgical patients. This gives him at once an idea of the relative frequency of the diseases of this organ or part. Then follows a classification of the various diseases admitted for treatment in the surgical clinic. Here the student learns the relative frequency of the various affections of this organ. If no examples of certain rare affections have come to the clinic for observation, it is so stated. The pamphlet then gives a summary of the clinical history and picture, treatment, gross pathological appearance and microscopic study of the various diseases of the organ discussed in the pamphlet which have been observed in the clinic, and, most important of all, the ultimate result after leaving the hospital. This general summary corresponds somewhat to what is contained in a chapter of a text-book on surgery. It has the advantage, however, of a monograph, in that it gives the summary of a certain number of specific cases, in each of which the diagnosis has been confirmed by a pathological study and in which the ultimate result is known covering a period varying from a few months to many years. Descriptions of rare diseases not observed in the clinic can be made from the literature with illustration. The second part of the pamphlet gives the clinical history, the treatment, the description of the fresh specimen which is preserved in the museum, and which the student can find on the table near the group to which he belongs. Then follows the microscopic description, and the student will find in his box of slides a section taken from the specimen he has just examined.

The general part of the pamphlet the student can read at home in connection with his text-book on surgery. When he comes to the laboratory he is advised to take a museum specimen, selecting the various diseases of the organ in a certain natural sequence. This specimen has a surgical and pathological number which is indexed in the pamphlet, so that the student can quickly turn to the clinical history of this case, and as in the majority of instances some years have elapsed since the patient has left the hospital the pamphlet is able to give him the ultimate result. Each museum specimen therefore is one identified with an individual, whose clinical history and ultimate result of his disease the student can read, and he can examine the microscopic section of the museum specimen by which the diagnosis was confirmed. By a careful reading of the pamphlet the student is brought in contact with the relation between the clinical, the gross pathological and the confirming microscopic diagnosis. In addition in the pamphlet he will find photographs of the patient illustrating the clinical appearance, diagrams, photographs of the fresh specimen, X-ray photographs if made, and in some instances photographs of microscopic drawings, and quite frequently photographs of the ultimate result.

Each group, as stated before, is given a pamphlet and a box of microscopic slides, and near the group are the museum specimens discussed in the pamphlets. From time to time the groups exchange material, so that by the end of the third year a large field of surgery has been covered.

I believe this method presents surgery to the student in just as systematic a manner as a didactic lecture, with the great advantage that he reads instead of listens, and with his reading he has object lessons, illustrative of the text. I have found very little demonstration to be necessary. The student works quietly by himself, as he would in the dissecting room or chemical laboratory. He is brought in close contact with the disease, with each specimen of which he can get in a few minutes the entire history of the case and the ultimate result. This is impossible if he sees the patient only. While this work in the laboratory is going on, the third-year student observes patients in the out-patient department and in the surgical clinic. When, for example, he sees a patient with the clinical appearance of an exophthalmic goitre he will have read in his pamphlet a summary of the clinical history, treatment and ultimate results of all the cases of exophthalmic goitre treated in the hospital up to that time, he will have examined the museum specimens of the thyroids removed and the microscopic sections; he will have seen numerous photographs before and after operation. In the fourth year he will be much better prepared to observe his patients clinically in the wards; when, for example, he sees a case of exophthalmic goitre in the ward, he can go to the library in the hospital and in a few minutes review his third-year instruction on this disease. If during the third and fourth year it is his misfortune to see few or no examples of various important diseases, he will at least in his third year have read the clinical history, seen the photographs, examined the museum and microscopic sections of one or more examples. This systematic method therefore prepares the student to make better use of the patients he sees clinically in the dispensary and in the ward, and it fills the gaps which cannot be avoided in clinical teaching.

Although the course is called one of surgical pathology its ultimate aim is really clinical diagnosis, taught, however, from the museum specimen and microscopic section instead of the patient. Clinical instruction should and must always be considered the most important part of medical teaching, and this laboratory course is by no means a substitute, but a supplement, its only object being better to prepare the student for instruction in the dispensary or at the bedside.

Such a laboratory course has the great advantage that it utilizes the material accumulated during the entire life of

the surgical clinic. The student is brought in contact not only with the patients observed during his two years' course of instruction, but with the entire experience of the surgical clinic. This method stimulates better records, more careful descriptions of the fresh tissues removed at operation and autopsy, and their preservation in the museum. It becomes a necessity to keep track of the patients treated in the surgical clinic; one is stimulated to get better illustrations, the history of every important case, every museum specimen; microscopic sections and photographs are as accessible to the student as a book in a hospital library.

The preparation of the pamphlet is not specially difficult. Once made thay can be added to from year to year. The photographs necessary for a set of 5 to 10 pamphlets and the microscopic sections will last for years. The museum specimen is practically indestructible.

In addition to the systematic course just described, fresh material from operations and autopsies is used. In the first part of the year every fresh specimen is assigned at once to a third-year student. The probabilities are that he has seen this patient in the dispensary or in the surgical clinic; in any event he is instructed to make a summary of the clinical history and record the clinical diagnosis. He examines and makes a description of the fresh specimen and makes his own naked eye diagnosis. The afternoon on which the entire class meets in the laboratory those students who have been assigned fresh material meet the instructor in a small room. The cases are discussed and frozen sections are exhibited. After the first of January the class meets on two afternoons in the week. By this time the students have had the opportunity from the systematic course and from the study of a certain number of fresh specimens to acquire a certain amount of familiarity with surgical diseases, and for this reason the demonstration of the fresh material is made before the entire class. The cases are presented by the student to whom the specimen was assigned. By this time the student has been brought in contact with the various surgical diseases from different standpoints. He has studied a number systematically in the pamphlets, illustrated by the museum specimens and microscopic section. He has examined personally a number of fresh specimens in conjunction with the clinical history. He has seen a certain number of cases clinically in the surgical dispensary and clinic. For this reason the student can better appreciate now a general demonstration and discussion on the routine fresh material, so that while he is continuing to study by himself, the experience of the surgical clinic of the past, he is brought more and more in contact with the material of the present. It is my rule to exhibit those specimens which the student has seen as fresh material again when it has become an alcohol museum specimen, so that he can compare the difference between the fresh and the alcohol specimen. As much as possible the student is informed of the ultimate microscopic diagnosis.

About once a month a lantern slide demonstration is given; the first demonstration, for example, on Inflammation and Tumors of the Thyroid, would be given to the class, after this pamphlet had been studied by each group. I am quite positive that the time necessary to give such a course is no more than that which would be taken by a course of didactic lectures. A properly prepared pamphlet is certainly better than any notes of a lecture which can be taken by a student. He can digest most surely what he reads better than what he hears, especially if during his reading object lessons in the shape of photographs, museum specimens and microscopic sections are before him. The instructor can confine his talking to the demonstration of fresh specimens, to general remarks on certain more difficult problems, and to a certain amount of personal instruction. The method of teaching is not only more satisfactory to the student, but infinitely more so to the teacher.

Such a course may be a difficult one to establish, but when once established, it can be maintained with a minimum of labor and a maximum of results. The good results are not only to the student, but to the teacher and to the surgical clinic.

SUMMARIES OR TITLES OF PAPERS BY MEMBERS OF THE HOSPITAL AND MEDICAL SCHOOL STAFF APPEARING ELSEWHERE THAN IN THE BULLETIN.

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J. L. Yates, M. D. Peritonitis in Typhoid Fever Without Perforation, with a Report of One Case Caused by Bacillus Typhosus, and Another Simulating Acute Appendicitis.—*American Medicine,* May 2, 1903.

Hugh H. Young, M. D. New Instrument for Perineal Prostatectomy.—*American Medicine,* June 13, 1903.

——— Some Renal and Ureteral Cases—Calculus and Tuberculosis.—*Maryland Medical Journal,* March, 1903.

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NOTES ON NEW BOOKS.

The American Year Book for 1903. Medicine. Edited by GEORGE M. GOULD. (*W. B. Saunders & Company.*)

In noticing the annual edition of this work one can only repeat the favorable opinions of previous years. It is turned to so frequently and has become so familiar that perhaps with use we are apt to forget how helpful it is. Not only the last volume but the previous ones are often employed for reference. Dr. Gould is to be congratulated on the continued ever excellence of the work.

The Medical Annual. A Year Book of Treatment and Practitioner's Index. (*Bristol: John Wright & Co. New York: E. B. Treat & Co., 1903.*)

With this number the Medical Annual reaches its twenty-first year. To those who have used it nothing need be said of its value. To others its purpose may be described as an endeavor to give a general "reflection of the knowledge of the year." Considerable attention is always given to new procedures in treatment. Certain subjects receive special attention. Thus, for example, in the present volume electrotherapy, diseases of the ear and cardiac conditions may be noted as of special interest. The list of new books is of value. This volume keeps up the standard of previous years.

INSTRUCTION IN PSYCHIATRY AND NEURO-PATHOLOGY.

A limited number of graduates in medicine can have an opportunity for work in the laboratory of the Sheppard and Enoch Pratt Hospital.

Instruction in neuro-pathology will be given by the director of the laboratory, and those attending the course will be permitted to attend the clinical and other conferences of the medical staff. Clinical forms of insanity will be discussed, as well as the hospital and home care of the insane.

Physicians taking this course will also have an opportunity to attend the neurological clinics at the Johns Hopkins Hospital.

For particulars, apply by letter to Dr. E. N. Brush, Physician-in-Chief and Superintendent, Sheppard and Enoch Pratt Hospital, Station "A," Baltimore.

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THE QUALITY OF THOROUGHNESS IN NURSES' WORK.

AN ADDRESS TO THE GRADUATING CLASS AT THE JOHNS HOPKINS HOSPITAL TRAINING SCHOOL FOR NURSES, MAY 28, 1903.

By Isabel Hampton Robb, *of Cleveland, Ohio.*

A little over thirteen years ago it was my privilege to greet for the first time a Baltimore audience and to become for a few years a resident of Baltimore City. And, like all others who have once lived within her borders or who have been in any way a part of the Johns Hopkins Hospital or University, I have always been eager to seize any opportunity that might afford itself of revisiting the place that has been endeared to me by work and association. So when Dr. Hurd did me the honor to ask me to address the graduates of to-day, the pleasant anticipation of finding myself once more surrounded by Johns Hopkins nurses, past, present and future, and of being again in touch with Baltimore, was not to be withstood. I am only too well aware of the fact that the retrospect and forecast I may hold before you to-day may not contain the full measure of inspiration and wise counsel that you may have hoped for, nor delight you with the happy phrasing that might have been offered you by many others who would gladly have accepted the honor of addressing you in my place; nevertheless I feel assured that no one could be found who is more profoundly interested than myself in your individual interests and work or who could draw more closely to you in those mutual professional ties and common interests into which you are about to enter.

At that first gathering the Johns Hopkins nurse was conspicuous by her absence. She was still in the future, her place was still to be made in the hospital and household; her history page was still fair and unwritten. But two years later the first class of graduates stood, where you now stand, prepared to leave their hospital and to go forth to form a new factor in the life of this city, to become part of it for better or worse; and each year since a fresh class has been added to the first until to-day our alumnæ form a goodly host. How they have sped, we of the household, who have watched their individual lives anxiously, know full well. The Johns Hopkins nurse has not only become a familiar presence in many homes both of the needy and of the well-to-do of this city,

but to various positions in other cities and countries she has also carried the well-known name of her hospital and school, doing both, we trust, honor and credit.

For the graduate of to-day that first class must need have a special interest, for early in its formation there came into its ranks one who was destined to become, a few years later, the chief executive of your school. From probationer to junior, from grade to grade, she worked her way up until there was no form of nursing within her reach she had not done, no nursing position the hospital had to offer she had not held. Thus year by year she went on with indomitable perseverance, unconsciously training mind and hands, so that when the time came there was no need for the hospital authorities to look beyond their own graduates for a principal for their school for nurses, since they had readily to hand one who was in every way capable of assuming a position of responsibility and trust equalled by few and excelled by none open to members of your profession. And it should be a matter of no small pride and pleasure to all Johns Hopkins nurses that with the exception of the first few years they have held within their own hands the welfare of the nursing department of their own hospital, and at the same time have contributed superintendents for similar positions to other hospitals in a greater proportion for the length of years it has been in existence than perhaps any other school in the country.

But if I recall these facts as affording a sufficient proof of the standard that your school has maintained; if I tell you that the eyes of the hospital world are ever watching with keen interest the progress made by this school, and that the superintendent of your school is an authority on nursing affairs, it is not that you may be puffed up or satisfied with yourselves, but rather realize the burden of the responsibility laid upon you, and that when you have done your best you may say with all humility, "We are unprofitable servants, we have done that which it was our duty to do," and strive to make the future stand for better work than the past.

There is perhaps no other outside of Miss Nutting's immediate co-workers who can be so well aware as myself of the steady progress made by this school; while carrying on its every-day work, she has lost no opportunity for its advancement and betterment, and leaving unmentioned for the moment the many minor but important changes and improvements she has made, it is a great satisfaction to feel that she should have been among the first to inaugurate successfully the three years' course of study, with an eight hours daily system of practical work, which marks one of the greatest advances in training school methods. Her last great achievement has been the establishment of a preliminary course of instruction for probationers, the great need for which has given me a subject ready to hand—a subject that one could readily discourse upon under many and various titles, but to-day permit me to speak of it in its relation to "The Quality of Thoroughness in Nurses' Work."

That there is a deep and widespread dissatisfaction felt at the lack of thoroughness in much of the work to-day and that this deficiency is confined to no particular class of workers, and to no particular degree of service, we are all aware. Nevertheless, although few of us escape the discomfort and annoyance attending upon it in some shape or form, at one time or another, we find ourselves still able to endure it with a certain amount of patience and equanimity, so long as it partakes of the impersonal. But once let it become personal in character, once let it enter the privacy of the home, and we are keenly sensitive and alive to defects in work of any kind and give expression to our feelings and opinions in no uncertain tones. But what worker is brought into more personal and intimate relationship with those with whom she has to deal than the trained nurse? All of us have heard a portion of the public sentimentalize and idealize the nurse with such fulsome flattery that we have sometimes prayed that we might be saved from our friends. On the other hand, we hear daily criticisms upon her many short-comings, and so often are these latter sounded in the ears of the medical practitioner, whose co-worker she is, that he is impelled to look for some favorable opportunity to appease his patients by laying all sorts of injunctions upon the nurse's manners and morals and finds it when making the annual address to the graduating class. And despite the fact that these recommendations have been made, almost without exception, in the kindliest spirit, how often have we, who have had much to do with the making of nurses, been deeply embarrassed that such advice should be deemed necessary, inasmuch as we have felt that if such faults lay wholly and entirely within the guild of nurses we must in common honesty refrain from adding one more member to the list. Graduates of the Johns Hopkins have been favored beyond their kind in having in years gone-by listened in most part to addresses that were an inspiration to better deeds and higher ideals in beginning their professional career. Although you too have been besought upon one or two notable occasions to enter upon your duties in the full consciousness of guilt of such sins and frailties that if you possessed them, and had not battled against them and overcome them long before reaching graduation day, the address of warning would have availed you but little. Do not let me be misunderstood. I am not saying that nurses are perfect. What I wish to point out is that it is more than possible that the glaring imperfections of the trained nurse—and she has many—are not in the main attributable to any lack of training in her profession but are shared by her with her fellows in other walks of life and are the result of imperfect education—and here I use the word education in the broadest sense of the term. In other words inefficiency, superficiality and lack of thoroughness belong not to the graduate nurse alone but are the common property of the modern woman and belong to the average American household.

In the statement that there is a sad lack of thoroughness in the average woman of to-day, I need only refer to training-school statistics to bear me out. From one school, in twelve months 1200 letters of information are sent out and some 175 formal applications are received. Furthermore, from this number only 50 candidates are selected, and nevertheless from this restricted number of women chosen, at least 8 or

10 are dropped generally for inefficiency and lack of education. If then only 40 women, out of a total of 175 applicants, are considered worthy of admission to the school, what is the probable standard of education among the other 135? not to mention the many women who do not make formal application because refusal is certain. Surely the superintendents of training-schools are justified in feeling that the unthinking part of the public would have them "make bricks without straw."

But the fact that the qualifications of these selected few are not, and never have been, considered by superintendents of training-schools of the first order for the making of nurses is now being proved rather by deeds than by words, and this dissatisfaction has found its expression in the establishment of a preliminary course of training, which is being tried in varying degrees in schools of this country and Great Britain and which has been put on a more thorough and comprehensive basis in the Johns Hopkins than elsewhere. This extra course has been made compulsory, before a woman can begin her technical training in nursing, in the hope of overcoming to some extent a very general ignorance and helplessness in a branch of knowledge that for century upon century has been supposed to be woman's chief stronghold—that of household economics. As Miss Nutting has said, "In pursuance of the belief that it is essential for the nurses to have a wide and thorough acquaintance with the subjects of foods and dietetics and a full knowledge of the work of the household, with careful training in its various branches a comparatively large portion of time is devoted to this subject"; and in addition to this special course in Household Economics, some training-schools are even advocating and arranging for a course in general literature and in practice in reading aloud, all subjects outside of the direct work of teaching nursing. No doubt many of you might think that the above statement cannot apply to all classes of women, but as a matter of fact actual experience has amply proved that the woman of wealth, the well-to-do woman, and the college student, are equally deficient in manual dexterity so essential to good nursing, and are as ignorant of the underlying principles of household affairs as is the woman who has never had an opportunity to develop her mental powers and has labored all her days with her hands. It can be scarcely appreciated how deficient women are in the practical knowledge of the affairs of the house, until one is brought face to face with such ignorance in some such place as a training-school for nurses, where it becomes one of the fundamental requirements. As an example, I have had instructors tell me that not one woman in ten upon first entering the diet school knows how to make a cup of tea properly, few could break an egg deftly enough to separate the yolk from the white, while the qualities of accuracy, precision and a fine finish are invariably absent. The woman who would be a success as a nurse or in fact in anything, who would possess the quality of thoroughness in its fullest sense, no matter what kind of work she undertakes, needs the combined qualities of a trained mind, capable hands and body—and all must be dominated by the soul. Certainly no form of education can make for thoroughness or can fully fit for the business of life that does not recognize an equal training in this great trinity—mind, body and soul.

But when and where should a woman receive such a preparation? Surely not during a six months' preliminary course in a training-school for nurses, but rather during the sixteen years preceding the time she is of age to take up the work she intends to make the chief occupation of her life. To quote the words of another, "The hospital is the place *par excellence* to teach the art of nursing and to practise the science, but it is not the best place or even a good place to teach the accessories. Moreover, in assuming the burden of this higher education we are unwisely making ourselves responsible for all the defects and deficiencies in the training of nurses and bearing the criticism against the profession, aimed for the most part not against her nursing education but the accessories." If then this education is to begin with our childhood, where and how should it be given? Naturally in the school and at home. But as Miss Nutting has said, "Were it possible to place the requirements of admission at such a point as would insure in our pupils a definite knowledge of certain prescribed subjects before entrance to the schools of nursing, it is manifest that our work of education might be greatly facilitated." That such a course under present conditions is not practicable is only too evident. Any scheme for such preparatory instruction should include, first a thorough practical training in the care of the household and a knowledge of the properties of foods. Now at present there exists no school of instruction where a candidate could go to prepare herself fitly in these subjects for entrance to the hospital school for nursing. To be sure the Drexel Institute in Philadelphia, the Pratt Institute in Brooklyn, the School of Housekeeping in Boston and some others, cover the ground of the domestic sciences admirably, and upon them we draw for our instructors in these branches. But the instruction in these institutions is largely occupied with the subject of foods and cookery, important essentials indeed, but which do not include all that is meant when we say that a pupil should have a knowledge of housekeeping before entering the hospital wards for her training as a nurse. Unfortunately this practical handling of the things and affairs of the home is taught in no schools and in but few homes at the present day," and, as Spencer has said, "That which our school course leaves almost entirely out, we thus find to be that which most nearly concerns the business of life."

The subject of the home in relation to the question of a three-fold education has of late years been well studied by well qualified investigators who have pointed out clearly and emphatically the shortcomings of the present day in this connection and have sought for and recommended various remedies through the application of which we may hope to arrive at a better state of affairs; but up to the present time the ground has hardly been broken and no great general advance has been made. Specialized efforts, such as these preliminary courses for student nurses, have already accomplished something directly and indirectly and are doing an im-

mense amount of good, inasmuch as they have emphasized the necessity for similar education in all forms of work.

Thoroughness in any form of education must have its roots deep laid in the home, and we women have much to do with it there, and are answerable in a great measure for the present inefficiency, ignorance, indifference and waste. For the souls of the little children are ours to begin with, "Marvellous delicate and tender things," says Olive Schriner, "and keep forever the shadow that first falls upon them, that is the mother's or at best a woman's." The world requires not more children, but a better quality, not the waste products of human life that so many are to-day. But at the present there seems to be but little hope for that ideal education for the child in whom lies the world's welfare, for the home is one of the few institutions left that still keep the drawbridge up and refuse to let progress and improvement enter within their gates. The individual still regards his home as his castle, in its most conservative sense, and still clings to old traditions, old systems and time-honored cookbooks, and refuses to come into line and be guided by association and combination, by economic laws and principles, and by the specialization of labor in its true sense which makes for thoroughness as no other way can.

But women cannot be held entirely responsible for the increasing difficult conditions in the household, and for the wholesale lack of thoroughness within and without. Progress in many forms has taken out of it a great variety of work that was once done in the household by women and the time formerly spent in these various duties has not been fully accounted for in other forms of activities. How long will it still be assumed about housekeepers, as it formerly was about nurses, that they are born and not made and that the only essential required is to be a woman; that a taste and knowledge for all things domestic is hers by divine right, that she intuitively knows all about the care and bringing up of children, the laws of health, hygiene, sanitation, foods and their preparation, suitable clothing and furnishings. And yet such a groundless assumption leaves her at the mercy of two very unstable teachers, Instinct and Experience, the former sometimes lacking, and the latter at all times to be acquired at a great cost. So at the present moment we have the spectacle of each household trying to be a training-school unto itself in domestic affairs, wasting the time of both mistress and maid in vainly trying to teach and to do things without any adequate knowledge of underlying principles, busy making patients for the doctor and nurse by jeopardizing the health of families by their woeful ignorance, and later themselves falling by the wayside a prey to worry and worn-out nerves.

Nor are these the least of the woes that befall the modern household through its want of proper organization, its old-time methods and its modern dangers. The rapid accumulation of great wealth and its consequent tendency to luxurious forms of living and ease have brought us very near to that point in the order of social change when a large class of women are in danger of becoming useless supernumeraries without an excuse for existing and a menace to the nation. The average man of the day devotes his energies early and late in the making of money, economizing labor at all points to compass his purpose, only to end in pouring his wealth into the hands of a wife or children who expend it in such profusion and lavishness of ignorance, as has made Americans stand for greater extravagance than perhaps any other civilized people.

Even a superficial consideration of the question then will readily show that the inefficiency of the trained nurse can justly be placed only where it belongs—in the lack of proper early education; and while the preliminary course of instruction for other reasons is excellent and will probably always exist, it is to be hoped that it will not always be necessary to devote so large a portion of the time to Household Economics. Any adequate remedy for the present state of affairs can only come through a true education of our women. They must be trained, disciplined to bear their due share of the work needful for the helping of the nation; they must be taught that the true value of money lies not in the luxury it may heap about them, but in the opportunities it affords, and that the true joy of living can only be found in congenial work. It would be well if all appreciated the fact that the existing or faulty order must inevitably continue until our women of wealth, refinement and intellectual attainments combine their talents, leisure and intelligence to bring the home into its proper place in the economic and scientific world by the readjustment of household work and by creating the desire and the demand that our sons and daughters, children of all ranks and grades, should be given a proper education; that from the beginning there shall go hand in hand the teaching of their numberless faculties that shall make for a practical and proper appreciation of the principles of art, education and labor and the joy to be found in each. For then and then only can they understand what life means and know how to live. Moreover, the preparation must be such an one as shall be a fitting preliminary training for their future occupation in life, whether it be that of the trained nurse, the physician, the housekeeper, statesman, artist or artisan; each one whether man or woman, being prepared to fill their chosen niche, happy in having found it and not, as now too often happens, being forced into occupations for which they often have neither the heart, head nor hand.

Upon both men and women are we dependent for the first steps that shall establish and thoroughly equip professional schools for the investigation of all subjects pertaining to the household, and that shall offer suitable inducements only to such persons as have the proper attainments for carrying on such studies, after which we may look for the establishment of technical schools for children, embracing all branches of work that in any manner touch the home. These schools should cover the country like a net-work, as do the public schools, and should co-operate with them; they too should have the authority of the law behind them for which the rank and the file of the people have due respect. In such schools should the trained nurse find her proper place. With her more intimate knowledge of disease and its causes and the

dangers that menace health, she is well fitted to be the teacher of home sanitation, hygiene, the personal laws of health, the true meaning of cleanliness and the prevention of disease. Despite the fact that bacteriologists are every day throwing more light upon the causes of disease, and each city is equipped with its health officer, hospitals are still being multiplied in the land, the supply of trained nurses is not equal to the demand, and our wards are just as full of typhoid fever patients as of yore. These facts must sometimes make us pause to question if we are not spending our labor and strength for that which profiteth not. But thus it must be until the public at large and as individuals have acquired a practical intelligent appreciation of the above subjects and of the duties of individuals and communities in the prevention of disease.

We need two orders of trained nurses, the new order of the co-operating health nurse with the old order for the sick, who must ever be with us. The appointment of a staff of trained nurses to the schools of New York by the Health Commission for the purpose of continuing the work in the public schools is the beginning of this new order, and is a hopeful sign of the times.

Graduates of to-day, we who are already of the guild greet you heartily and give you cordial welcome to your place among us. In your future work we see much of hope and promise. When you have grown a little older and have had a more varied experience, you will realize that the mere care of the patient is the least part of your work compared with what you can and ought to do towards making the conditions that cause pain and sickness and all manner of suffering less possible.

In the last issue of *The American Journal of Nursing*, Miss Dock says: "After one has worked for a time in healing wounds which should never have been inflicted, tending illness which should never have developed, sending patients to hospitals who need not have gone if their homes were habitable, bringing charitable aid to persons who would not have needed charity if health had not been ruined by unwholesome conditions, one loses heart and longs for preventive work, constructive work—something that will make it less easy for so many illnesses and accidents to occur, that will help to bring better homes and workshops, better conditions of life and labor." And this expressed longing finds its echo in the heart of each of us who have learned by experience that the faithful nursing of the patient, the splendid work done in so many forms of philanthropy and the efforts of religion do not reach the root of the matter. In your professional life you have learned that we may dress and nurse a wound ever so carefully, but that all your work represents time and energy expended in vain, that a breakdown of the wound is inevitable, did not the surgeon first clean and scrape away all the diseased tissues, reaching deep down into the fresh healthy part until no germ of disease was left to impair the growth of new, healthy flesh. And so it is with our work in caring for humanity in other ways—we are but staying a worse condition perhaps, but not removing the cause if we rest satisfied with mere treatment and do not direct our best energies towards prevention.

You are, therefore, to be congratulated in your choice of work, you are entering a field of labor that is ever widening and where each can make for herself a definite place in rendering such ideals of education, as I have but haltingly tried to show you to-day, practical facts. More especially are you to be congratulated in your choice of a school where the standard of excellence desired for its graduates is so clearly set forth, and where there is placed within the reach of pupils the possibility of that quality of thoroughness that is the great need and demand of the day.

THE ANATOMY OF THE PANCREAS.*

BY EUGENE L. OPIE, M. D.,

Associate in Pathology, Johns Hopkins University.

In the brief time at my disposal I will review a few facts which have an important bearing upon the physiology and the pathology of the pancreas and will emphasize especially those which as yet have attracted little attention. The pancreas performing a variety of diverse functions is more complex in structure than the other glandular organs which it closely resembles. Pathological alterations have given importance to many anatomical details previously regarded as insignificant.

The earlier anatomists, among them Galen and Vesalius, gave, it seems, little thought to the organ, believing that it acted as a cushion to support and protect the adjacent structures, and it was not until the middle of the seventeenth century that the duct of the gland was discovered by Wirsung, who thus made possible a proper interpretation of its physiology. The organ has since been regarded as a type of secreting gland and to its study we owe many of the facts that have served to explain the process of secretion in general. The so-called salivary gland of the abdomen resembles the salivary glands of the mouth, but the peculiarities which characterize it have been known only since Langerhans in 1869 published

* Read before the Congress of American Physicians and Surgeons, May 12, 1903.

his dissertation describing its minute anatomy. Yet until the last few years the histological structures which bear his name have attracted so little attention that their significance has remained obscure.

Few organs are subject to greater variation than the pancreas, and of these variations particularly I wish to speak. Santorini and subsequent anatomists have shown that it is provided with an accessory duct which, in some cases, can act as an outlet for the pancreatic juice, should the larger duct be occluded. In different vertebrate species and even among members of the same species the ducts of the pancreas vary greatly, and until recently it has been believed that the embryonic origin of the organ is subject to equal irregularity, but evidence that is still accumulating has shown that development follows a plan which is common to all species of vertebrates.

The organ makes its appearance as an outgrowth or bud upon the dorsal aspect of the intestinal canal at a point between the hepatic duct which has already appeared and what will subsequently become the stomach. A little later two additional embryonic buds develop at either side of the hepatic duct upon the ventral aspect of what is now the duodenum. The subsequent history of these rudimentary structures varies in different species. In man one of the two ventral outgrowths disappears, fusing, perhaps, with the other, so that the adult gland is formed by the union of a ventral part in contact with the bile duct and a dorsal part which forms the greater mass of the organ.

In accordance with this plan of development the gland is in most cases provided with two ducts of which the larger, the duct of Wirsung, enters the intestine in company with the common bile duct. The smaller accessory duct, the duct of Santorini, terminates in a papilla situated nearer the stomach than that of the larger duct. I hope I will not seem to cite unnecessarily well-known facts, if I recall the usual relation which exists between these two ducts. The duodenal orifice of the accessory duct is very minute; receiving branches from all sides, the duct increases in size and finally joins the duct of Wirsung, into which during life it doubtless pours its contents. Variations from this normal or usual type have been frequently noted. In many instances the two ducts fail to anastomose; at times that which is nearer the stomach, namely, the duct of Santorini, is larger than the duct of Wirsung; often the duodenal orifice of the accessory duct is obliterated, while occasionally one or other duct has not been found. More surprising, in view of the embryological relations already described, is the claim that the bile duct occasionally enters the duodenum in company with the duct of Santorini, while the duct of Wirsung enters the intestine at a point more distant from the stomach. In such case the dorsal embryonic bud, in which originates the duct of Santorini, could not have arisen from the duodenum at a point between the hepatic duct and what will become the stomach.

Are the variations to which the pancreatic ducts are subject in the adult explicable upon the supposition that the pancreas develops from three original buds which bear a constant relation to the bile duct? Of more practical interest is the functional significance of the two ducts and their relation to lesions of the liver and pancreas. In order to obtain data more accurate than those at present available, I have dissected the ducts after injection in one hundred subjects. The results of this examination, differing in some important particulars from those previously obtained, will be, I hope, of some interest.

Though the ducts varied considerably, there was no departure from the embryological type already described. Two ducts were present in every instance, but occasionally one or the other was so small that it was found with difficulty. The common bile duct always joined the duct of Wirsung, while the duct of Santorini, unaccompanied, entered the intestine at a level nearer the pylorus. In ten of one hundred instances the two ducts failed to anastomose within the gland, and in four additional subjects the two ducts were united by such a minute twig that they might be regarded as independent of one another. In twenty instances the duodenal end of the duct of Santorini was not patent. These figures show that in at least a third of all individuals the duct of Santorini cannot act as an accessory outlet when the duct of Wirsung is occluded. Moreover, in a considerable number of specimens the orifice of the duct of Santorini, though patent, was so minute that its functional significance was slight, the accessory duct being functionally a branch of the larger channel. In eleven of one hundred specimens the duct of Santorini, on the contrary, was equal in size or larger than the duct of Wirsung, so that during life it was doubtless the outlet for a considerable, if not the larger part, of the pancreatic juice.

Since cholelithiasis and other changes in the biliary passages are frequently the cause of lesions of the pancreas, the relationship of the pancreatic duct to the common bile duct has assumed increased importance. The two ducts usually unite to form a short common channel, the diverticulum of Vater, which is subject to almost as much variation as the pancreatic ducts themselves. I have examined the orifice of the two ducts in one hundred specimens. In eleven instances no diverticulum was present and the two ducts entered the duodenum separately at the summit of the bile papilla. In the remaining cases the diverticulum varied in length from less than one to eleven millimeters, while in only thirty specimens did this measurement equal or exceed five millimeters. The duodenal orifice of the diverticulum of Vater had an average diameter of two and a half millimeters. The figures are cited to show that unless a calculus, which has become impacted within the orifice, be of very small size, it will completely fill the diverticulum and occlude both ducts that enter.

The pancreas consists of a duodenal part, the head, and a narrower body which constitutes the greater part of the organ and is not definable from the splenic extremity, designated the tail. This classical description should, I think, be somewhat altered, for the head, I find, consists of two well-defined lobes corresponding to the two ducts of the gland. The anterior and lower part of the head is tributary to the duct of San-

torini and consists of lobules grouped about the duct and its branches. A second lobe is formed by a smaller mass of parenchyma disposed about the duct of Wirsung as it passes through the head of the gland, and is situated behind the larger lobe. In the specimens which I have examined a cleft filled by loose areolar tissue separates the two lobes and is demonstrated most readily after the gland has been placed in a hardening fluid. The adjacent lobular surfaces, when exposed, are as smooth and well-defined as the external surface of the gland. This interlobular cleft, in contact with the duodenum, lies midway between the two pancreatic ducts and its depth depends upon the distance from the duodenum at which the ducts anastomose.

Recent observations have disclosed a fact which, seemingly of little importance, serves to explain the occurrence of certain abnormalities of the gland. Within the papilla of the duct of Santorini, Helly has found in many individuals lobules of pancreatic parenchyma situated immediately below the duodenal mucosa. Occasionally provided with an independent duct which enters the duodenum near the orifice of the duct of Santorini, they constitute a true accessory pancreas. Studying the papilla in the embryo, Helly found that this pancreatic tissue originates at a very early period of development from lateral branches which bud from the duct as it passes through the mesoblastic layers of the intestinal wall.

This process, I believe, explains the occurrence of small masses of aberrant pancreatic tissue embedded in the wall of the stomach or of the intestine, at a variable distance from the pancreas. Such aberrant glands are by no means so rare as has been supposed. I have collected from the literature only twenty-two examples, but in eighteen hundred autopsies performed in the Pathological Laboratory of the Johns Hopkins Hospital this anomaly has been observed in ten cases. Nodules of pancreatic tissue one or two centimeters across have occupied the submucosa or muscularis of the stomach, duodenum or jejunum. In seven cases the accessory gland was situated above the pancreas in the wall of the stomach or of the duodenum, and in three cases below the pancreas in the duodenum or in the jejunum. Of some importance, as will be shown, is the fact that in two instances two accessory glands occurred in the same individual.

The earlier writers, notably Zenker, assumed that an aberrant gland arose from an accessory embryonic outgrowth or bud from the intestinal canal. The constancy with which the pancreas of all vertebrates develops from three definitely situated duodenal outgrowths has, however, made it improbable that in man such a fundamental process is subject to variation. At the same time, this multiple origin has suggested that one of the embryonic structures which normally disappears may persist as an accessory pancreas.

In one case from the literature and in two of my cases two aberrant masses of pancreatic tissue were situated either above the pancreas, as in my cases, or below the pancreas, as in the case of Zenker. The existence of more than one accessory gland cannot be explained by the persistence of one or more embryonic structures, for in my cases the pancreas itself had undergone normal development and was provided with two ducts. A more probable explanation is the following: At a very early period of embryonic life a lateral branch of the pancreatic duct entangled in the mesoblastic layers of the intestinal wall is, by longitudinal growth of the intestine, carried a variable distance from the pancreas and a new duct is formed in much the same way that the pancreatic duct regenerates after section. In confirmation of this hypothesis I have found pancreatic tissue in the papilla of the duct of Santorini in two cases—the only ones examined—in which aberrant glands were found in the wall of the stomach, and in one case in which an aberrant gland was situated in the jejunum, that is, below the pancreas, lobules of pancreatic tissue were found within the bile papilla about the duct of Wirsung as it entered the intestine. Here pancreatic tissue has been rarely, if ever, found.

Histology of the Pancreas.—The larger ducts of the pancreas are lined by high columnar epithelium. The cells which form the smaller ducts become lower and finally flat as the secreting acini are approached. The acini are composed of large cells containing zymogen granules which, as Heidenhain has shown, present characteristic variation during different stages of secretion. Within the lumen of each acinus Langerhans found cells which resemble those of the terminal ducts and represent, as it were, an invagination of the duct into the lumen of the acinus. The nature and the significance of these centro-acinar cells is not known. Of greater importance are the structures to which their discoverer's name has been given, the so-called islands of Langerhans.

Scattered amongst the secreting acini, several times the size of a single acinus, they are round or oval bodies composed of polygonal cells grouped together to form short, tortuous columns, which unite with one another in such a way that space is left for a network of wide capillary blood-vessels. If the blood-vessels of the pancreas are injected, glomeruli of tortuous dilated capillaries represent the capillary vessels of the interacinar islands, and though they have a superficial resemblance to the glomeruli of the kidneys, unlike the latter, they freely communicate by numerous anastomoses with the capillary network of the surrounding tissue.

The interacinar islands have been found in many species of mammals, birds and amphibia. For a time it was claimed that certain species did not possess them, but extended comparative studies have demonstrated the occurrence of analogous structures in all higher vertebrates and in a constantly increasing number of reptiles and fish.

The embryological studies of Laguesse and others have shown that the cells which form the islands of Langerhans have a common origin with those of the secreting acini, and

in the syphilitic pancreas of the fœtus I have found that the columns of the island as a result of retarded development are continuous with the small ducts of the gland. When, however, the organ has completed its development the islands are wholly independent of the secreting elements and it is not possible to trace a communication between the ducts of the gland and the interacinar islands.

The islands of Langerhans consist of columns of cells in intimate relation to a rich vascular supply and, having no communication with the pancreatic ducts, resemble in structure certain ductless glands, the parathyroid bodies and the adrenal glands and somewhat less closely the thyroid glands. Common to all vertebrate species, they doubtless have some important function. Independent of the secreting elements of the gland, they are not concerned in the elaboration of the pancreatic ferments. The relation of their cells to a rich vascular supply suggests that their action is through the medium of the blood. Abundant evidence in accord with these facts has shown, I believe, that the islands of Langerhans exert that influence upon carbohydrate metabolism which was formerly attributed to the pancreas as a whole.

In the human pancreas as in the human liver the lobules of the gland are not sharply defined, but in certain lower animals they are more clearly outlined by septa of connective tissue. In the pancreas as in many other organs the smallest lobule constitutes a unit of structure which repeats itself throughout the parenchyma. In the pancreas of the cat, for example, such a lobule outlined by connective tissue consists of a group of acini drained by a single duct; in some parts of the gland every lobule contains near its center an island of Langerhans. From the small arteries and veins which lie in the periphery of the lobule capillary vessels penetrate between the acini; several wide capillaries supply the rich vascular network of the island of Langerhans.

In man the individual lobules are often so fused together that their outlines are not discernible, but in general the same plan of structure exists. Of some importance is the fact that islands of Langerhans are not equally abundant in all parts of the gland. Actual count demonstrates that they are about three and a half times more numerous in the splenic extremity of the gland than elsewhere. In the pancreas from different individuals, moreover, the number varies considerably, and it is possible that in some instances as the result of a congenital defect the interacinar islands are too few to exert a normal influence on carbohydrate metabolism. In the pancreas of a child who died with diabetes the number of islands of Langerhans was almost a third of that usually present; the disease in this case was hereditary and affected six members of the same family. It suggests the possibility that diabetes may occasionally be the result of a congenital anatomical defect in the gland. The evidence in favor of such an hypothesis is at present inconclusive.

In conclusion, I may say, that two anatomical peculiarities of the pancreas, I believe, have not as yet received the attention they deserve from the physiologist, the pathologist, and the clinician. In the first place, the organ consists of two functionally diverse elements,—on the one hand cells which supply to the intestine important digestive ferments, and on the other hand, cells having no communication with the ducts of the gland but in intimate relation to the blood-vessels. In the second place, the close anatomical relation of the pancreatic duct to the common bile duct favors the transmission of morbid processes from the liver and bile passages to the pancreas.

UNCINARIASIS. REPORT OF A CASE OF INFECTION WITH THE AMERICAN SPECIES.

By Thomas R. Boggs, M. D.,

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The recently published discovery by Stiles of an American species of Uncinaria has aroused much interest, and it would therefore seem worth while to present in some detail before the Society the first case observed in the Johns Hopkins Hospital.

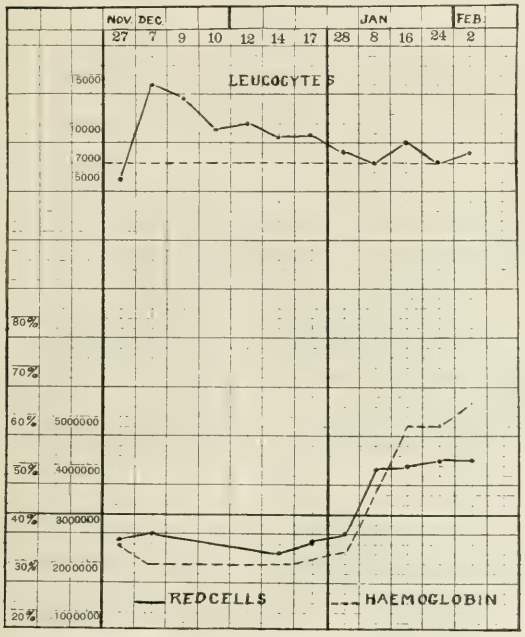
The patient, a white man aged 22, was admitted to Dr. Osler's service, November 26, 1902. A native of eastern North Carolina, he worked as a farm hand and taught school. He complained of "anæmia" and general weakness.

Family History.—This was unimportant except that a brother aged 25, died 3 years ago of "pernicious anæmia," having exhibited symptoms much like those of patient.

Personal History.—He has never been robust. There was no history of malarial fever, nor of severe illness until the present trouble. He had been subject, to "spells of weakness" for several years past. These he attributed to the excessive use of snuff. No special symptoms referable to circulatory or respiratory tracts other than shortness of breath on exertion, had been present. His appetite and digestion were fair, although he had occasional attacks of nausea and vomiting. There was no history of dysentery or diarrhœa until the present illness. He had never observed blood in his stools. He had never been jaundiced, nor had attacks of abdominal pain. He had always been rather sallow, though never so pale as now. There was

no history of venereal infection. He had used snuff, by rubbing on the gums, for more than five years, often to excess. He used alcohol moderately. He had worked until the present illness and had studied and taught school during part of each winter. He had always lived in North Carolina, and had never been in any seaport nor associated with foreigners. His average weight was 140 pounds.

Present Illness.—The patient had a severe attack of measles in March, 1902, and has never recovered his former strength. He worked most of the summer, although he felt unwell. About October 1st he began to have indiges-



BLOOD CHART.

tion, some headache, occasionally dimness of vision, and irregular diarrhœa. He did not see any blood in the stools. There was also some "cold" with cough and pain in the back. The indigestion and diarrhœa continued irregularly, the stools were never more than four a day. There was steadily increasing weakness and pallor. No swelling of the legs was noticed.

Physical Examination.—Patient has evidently lost flesh. The skin is pale and has a slight yellow tint. The mucous membranes are pale but nowhere pigmented. No special pigmentation was visible over surface of body. The teeth are sound. The pupils are moderately dilated, equal and react well to light and during accommodation. The sclerotics have a faint yellow tinge.

Thorax is well formed—expansion fair and equal. Vocal fremitus is good and equal. The lungs seem clear on percussion and auscultation. There is marked myoidema.

Heart.—The maximum impulse is in the fourth interspace, i. e., 8 cm. from the mid line. There is no increase in area of cardiac dulness. A soft blowing systolic murmur is heard at the apex, becoming more intense along the left sternal border and reaching a maximum in second left interspace. The pulse is 92, small, soft, regular, no marked thickening of vessel walls.

The abdomen is not distended, respiratory movements well marked, no rose spots, or visible peristalsis. The walls are everywhere soft, no tenderness. The liver dulness begins at the 6th rib and extends 8 cm. in right nipple line. The spleen is just felt. There is no general glandular enlargement.

Blood Count.—R. b. c. 2,742,000; hb. 37%; w. b. c. 5500.

A specimen of feces obtained and examined during the visit showed eggs of *Uncinaria* in very considerable abundance. They were mostly in well advanced segmentation.

December 3d.—The patient's general condition is unchanged, he complains of shortness of breath. Eggs of *Uncinaria* are plentiful in stools but no worms have been passed.

To-day thymol was given, 4 grams in two doses at intervals of two hours, followed after four hours by 30 grams of castor oil. The first stool after the purge was lost, but in remaining stools for the 24 hours a small number (12) adult worms were found. These showed on examination absence of ventral hooks and the presence of a large median dorsal tooth in the buccal cavity. The copulatory bursa of the male worms was characterized by a dorsal ray divided to its base, the two branches having a bifid tip. These anatomical points clearly marked the species as *Uncinaria Americana* (Stiles 1902), and the diagnosis was confirmed by Dr. Stiles, who kindly examined the specimens.

December 7th.—The patient's temperature has remained elevated with remissions since he came to the hospital. To-day he complained of pain and tenderness of whole left leg most marked about Poupart's ligament. On examination there is definite swelling in the left groin and throughout the whole leg, with marked increase of local temperature and great tenderness all down the inner side of thigh. No redness is observed. The foot is warm and there is no discoloration. Pulsation seems slightly less in left femoral and anterior tibial arteries.

December 8th.—The left leg is more swollen and very painful. A rectal tube was passed and numerous segmenting ova found in the feces.

December 10th.—The general condition of patient is fairly good, the leg still very much swollen, but no longer painful. Ova are still plentiful in stools. The patient was given a second dosage of thymol, 4 grams, followed by castor oil as before. The stools were carefully saved and examined. Twenty-four adult worms were expelled, 21 females, 3 males.

December 11th.—The patient complained last night of

pain in lower right axilla, where suppressed breathing and a dry friction rub were made out. No tubular breathing was heard. The whole left leg is still much swollen. The sputum is negative on examination for B. tuberculosis.

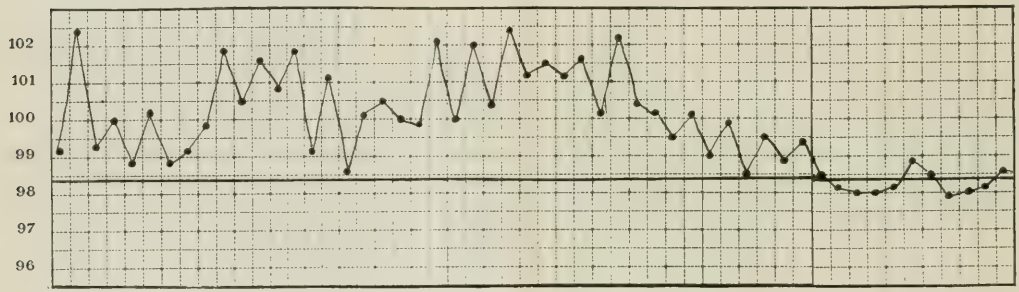
December 13th.—Lungs seem clear on examination.

December 14th.—Careful ophthalmoscopic examination showed the eye grounds practically normal. Eggs of *Uncinaria* are still numerous in stools. The patient was ordered thymol, 5 grains every 4 hours, for 48 hours.

December 18th.—The patient is much improved in general condition. His temperature is normal. Eggs of *Uncinaria* are still readily found in stools. The thrombosis of the left leg is subsiding.

January 5th.—Prof. Osler notes: "There is still slight fulness on the inner side of the left upper thigh and a distinct cord palpable to the inner side of left femoral artery."

The patient continues slowly to improve as shown by his general condition and blood counts (see charts). The ova persisting in the stools, thymol was given as before described on January 4th, 7th, 11th, 18th, 26th, 30th. On four days whiskey 30 cc. was given with the thymol, as some authorities insist that the drug acts more powerfully in the presence of alcohol. We were unable to detect any increased activity however in this case.



TEMPERATURE CHART.

On February 1st and 4th, male fern was administered after fasting and followed by a purge, and at present writing, some days later, a few eggs may still be found in stools. The thrombosis in left leg has almost entirely disappeared and gives no trouble, and the patient has gained in weight and strength and seems normally intelligent as contrasted with his former apathy. The patient was discharged well on February 15th. No eggs had been found in the stools for nearly ten days.

The principal points of interest in this case are its close resemblance to the Egyptian and European cases as described by Sandwith, Leichtenstern and others. It is also a comparatively recent infection in an adult and so opposed to the great predominence in children as shown by Stiles, Harris and other recent American reports.

The occurrence of general symptoms of intoxication is noted by most writers on the eastern species. Sandwith notes fever in 68 per cent at some stage, usually at the onset of the worst symptoms. Ashford also noted fever in his Porto Rican cases. Eosinophilia is noted by most writers who have made differential counts.

Ashford's cases averaged 10.1 per cent. Leucocytosis is absent except in complications; this is well shown by the counts before and after the thrombosis in this case. While subjective symptoms of dimness of vision and giddiness are noted, the ophthalmoscopic findings are usually negative.

The difference in the proportions of hæmoglobin to the red cells in Uncinariasis and in chronic paludism found in the same or nearby localities is fully discussed by Giles, Rogers and others for the Old World species, but so far no statistics have been compiled in this country.

It is most interesting to note the extreme resistance of the worms to any and all drugs in some cases. The great mass of opinion and experience confirms thymol as the best of all for this worm, and it must be administered repeatedly at intervals of 4 to 10 days until the eggs no longer are found in the stools. Sandwith in his exhaustive report shows rather strong proof that the administration of alcohol with the thymol renders it more toxic to the patient. In the literature accessible to me I have been unable to find any case of thrombosis reported as a complication, although it might reasonably be expected with the extreme anæmia so frequently noted. Several of the European authors mention pulmonary complications.

At the suggestion of Dr. John L. Yates, of the University of Pennsylvania, an attempt was made to test for the presence of hæmolysins and eosinophilic chemotaxis in the emulsion of the worms. But the very small quantity of material available at any one time, and its more or less imperfect preservation renders the negative results entirely inconclusive.

In closing I wish to thank Dr. Briggs for much assistance in furnishing me the data of the case in the latter part of its course.

The differential counts of the leucocytes are as follows:

DIFFERENTIAL COUNTS. 500 LEUCOCYTES COUNTED.

DATE	Nov. 27 %	Dec. 16 %	Jan. 8 %	Jan. 16 %	Jan. 24 %
Polymorphonuclear neutrophiles	51.8	*75.4	53.24	56.57	62.8
Small mononuclear.	26.4	10.4	27.37	31.2	26.0
Large mononuclear Transitional	15.4	8 2	6.08	5.26	5.4
Eosinophiles	4.6	5.6	°12.92	6.90	5.4
Mastzellen	1.8	0	0.20	0.30	0.4
Normoblasts seen in count of 500 leucocytes	0	0	10	10	0

*Count made during the leucocytosis accompanying thrombosis.
°Count made the day after a course of Thymol; the Eosinophilia is strikingly higher than at any other period.

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SOLITARY TUBERCLE OF THE STOMACH.

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(From the Pathological Laboratory of the Johns Hopkins University and Hospital).

The following case of a hitherto undescribed form of tuberculosis of the stomach was found at autopsy:

Clinical History.—L. B., female, negro, age 88, was admitted to the medical ward of the Bay View Asylum on Jan. 15, 1903. No family or personal history could be obtained. The patient was much emaciated, unable to stand from extreme weakness and refused to answer questions. Her appetite was poor and she refused all except liquid food. Physical examination showed the presence of the cardiac and pulmonary lesions found at autopsy. The urine, sp. gr. 1018, was acid and contained a few hyaline and granular casts. She continued in much the same condition until Jan. 20, when the physical signs of a bronchopneumonia became evident in the right lung, and she died, 9 A. M., Jan. 23.

Autopsy.—1.30 P. M., Jan. 23. The body was that of a much emaciated negro female. Rigor mortis was present. There was no lividity. There was onychogryphosis of all the toes of both feet. There were a few slight ecchymoses over the right knee joint. The subcutaneous fat was practically wanting. The abdominal muscles were very thin and of a pale reddish-yellow color. The great omentum was firmly adherent to the anterior abdominal wall and to the underlying small intestines. The coils of small intestine were matted together and adherent to the Fallopian tubes, ovaries and uterus. The latter were firmly bound down to the rectum and posterior wall of the pelvis. The stomach was slightly adherent to the liver near the pylorus. The appendix, 7 cm. long, was free from adhesions, possessed a mesentery and contained three small fæcal concretions. All the adhesions were old and formed of firm fibrous tissue. The liver reached 11 cm. below the xiphoid. The diaphragm reached the 5th space on the right side and the 4th rib on the left side.

On opening the thorax, the lungs were found to overlap the pericardium. The left lung was adherent at the apex posteriorly and to the diaphragm by firm fibrous adhesions. The right lung was adherent throughout by similar adhesions. The pericardium was adherent to the heart throughout, completely obliterating the pericardial cavity. The adhesions were fibroid and so firm that the pericardium could not be separated from the heart. The heart was large, rather soft, and showed old warty vegetations on the pulmonary and mitral valves. The aortic valve showed arterio-sclerotic changes. The heart muscle showed fibroid patches. The coronary arteries and base of the aorta showed sclerotic changes.

The left lung was rather voluminous and crepitant throughout. It showed dilated alveoli along the anterior margin. The surface was deeply pigmented, irregular from scattered areas of emphysema, and smooth except over the adherent areas. No nodules could be felt in the lung and there was no scar at the apex. On section the lung showed a considerable increase in fluid. The right lung was rather large and its anterior edge was adherent to the pericardium. The appearance, except for the presence of some firm nodules in the lower lobe was similar to the left lung. On section the lung was of a deep red color. The upper lobes exuded a large quantity of frothy fluid. The lower showed a number of raised slightly yellowish areas; evidently patches of bronchopneumonia. There was no scar at the apex and none in the other parts of the lung. The bronchi contained a thick purulent fluid and the mucosa was injected. The bronchial and tracheal glands were firm, deeply pigmented, not markedly enlarged and on section revealed no evidences of caseation.

The spleen, liver and kidneys, while pathologically interesting, showed nothing bearing on the case. The gall bladder contained

a large number of small reddish-black calculi. The gall ducts were patent. The pancreas and adrenals were normal. The bladder and ureters were normal. The uterus was small and atrophic and contained a small fibro-myoma. The ovaries and Fallopian tubes showed nothing bearing on the case. The vagina was normal. The retroperitoneal and mesenteric lymph glands were normal. The intestines were normal.

The stomach was small and somewhat vertically situated, the pylorus lying just to the left of the middle line opposite the fourth lumbar vertebra. The surface was smooth except at a point 6 cm. from the cardiac orifice, along the greater curvature, where an area of thickening of the peritoneum was seen. Corresponding to this a tumor could be felt lying in the stomach and occupying the greater part of its lumen. The tumor was semi-fluctuant and was completely covered by the ribs. The external contour of the stomach was unaltered. The stomach was opened along the middle of the anterior surface and the tumor was then seen to lie entirely in the stomach wall and was covered by a perfectly intact mucosa which bulged into the lumen of the organ at this point. The tumor was 3.5 cm. in diameter and almost spherical. On opening it was found to contain a quantity of thick yellow caseous material which flowed with difficulty. The wall of the tubercle was found to consist of necrotic material. The mucosa of the stomach was slightly injected and covered with mucus. Near the pylorus were several small superficial ulcers, varying from 3 mm. to 1.2 cm. in diameter. These were surrounded by a zone of bright red mucosa.

The œsophagus showed two small diverticula, 2 cm. below the bifurcation of the trachea. No lymph glands were found in relation to them. The intestines and rectum showed nothing of interest. The aorta showed numerous arterio-sclerotic ulcers. The brain and spinal cord were normal.

Anatomical Diagnosis.—Bronchopneumonia; chronic bronchitis; emphysema; chronic pleuritis; chronic fibroid pericarditis; fibroid myocarditis; chronic verrucose endocarditis of the pulmonary and mitral valves; chronic sclerotic endocarditis of the aortic valve; sclerosis of the coronary arteries; arterio-sclerotic ulcers of the aorta; chronic peritonitis; diverticula of the œsophagus; caseous tubercle of the stomach; ulcers of the stomach; atrophy of the spleen; perisplenitis; chronic interstitial nephritis with cysts of the kidneys; cholelithiasis; concretions of the appendix; fibromyoma of the uterus; onychogryphosis.

Microscopical Examination.—Portions of all the organs and any suspicious lymph glands were hardened in Zenker's fluid, and, in addition, pieces from the walls of the tubercle, the superficial ulcers and the normal stomach mucosa were hardened in formalin.

The right lung showed areas in which the alveoli were filled with red blood cells, polymorphonuclear and other leucocytes, desquamated alveolar cells and a small amount of fibrin. The vessels in the alveolar walls were dilated and filled with blood. The center of several of the larger of these areas did not stain well and was evidently necrotic. No giant cells could be found and nowhere could any structure be made out which could be considered a tubercle. The alveoli of both lungs were large and in many places the interalveolar walls were wanting. The bronchi were much injected and filled with mucus containing a few leucocytes.

The adhesions in the pericardium, pleuræ and peritoneum consisted of ordinary connective tissue with very few nuclei and vessels. There were no giant cells or masses which could represent the remains of a tubercle. The lymph glands showed no evidence of tuberculosis. The other organs showed no lesions in any way bearing on the origin of the tuberculosis.

Sections from the various parts of the stomach removed were stained with hæmotoxylin and eosin, Mallory's stain for connective tissue and for tubercle bacilli. Smears from the caseous material in the tubercle were stained in hæmotxylin and eosin, Löffler's methylene blue and Mallory's method for tubercle bacilli. One cubic centimeter of the caseous contents of the tubercle in sterile salt solution was injected into each of two guinea pigs; one intraperitoneally, the other subcutaneously. The former died on the nineteenth day after inoculation and no evidences of tuberculosis were found either histologically or bacteriologically. The second was killed at the end of seven weeks and tubercle bacilli were found in smears from a nodule formed at the point of inoculation, from the enlarged inguinal lymph glands and the spleen. Histologically, the point of inoculation, the inguinal lymph glands, the spleen and the liver showed tubercles in an early stage. Portions of the inguinal lymph glands, placed on dog's blood serum, showed the presence of the tubercle bacillus in pure culture.

Sections from the stomach in normal areas showed a slight atrophy of the mucosa, with increase in the intertubular connective tissue and the mucus secreting cells. Those through the superficial ulcers showed a loss of the outermost part of the mucosa with injection of the vessels. No tubercle bacilli could be found in any of the sections examined.

The tubercle showed the following structure: The mucosa covering it was perfectly intact. There was no evidence of ulceration or of an active inflammatory process, and it in every way resembled that from other parts of the same region of the stomach. The submucosa showed no change beyond a slight injection of the vessels similar to that seen elsewhere in the stomach. The muscularis was split into two layers, between which lay (1) a layer of connective tissue passing gradually into (2) a layer of cells which gave place to (3) the caseous material of the tubercle. The cells in the second layer were of three types: (1) cells with large, deeply-staining nuclei and little protoplasm; (2) so-called endothelioid cells, which in some places were arranged concentrically around (3) a few scattered multinuclear giant cells. At the edges the splitting of the muscularis into two parts could be easily seen. The peritoneal surface was thickened by a layer of connective tissue inside of which could be distinctly seen a thin band of non-striped muscle, in some places split into overlapping islets by the connective tissue growth. This was beautifully shown by specimens stained by Mallory's connective tissue stain. Inside of this, as before mentioned, was the layer of connective tissue surrounding the tubercle, the thin band of non-striped muscle lying between the two layers and being continuous with the muscularis at the edges of the tubercle. Sections stained by Mallory's method for tubercle bacilli showed the presence of a few bacilli chiefly in giant cells.

The smears made from the caseous material showed nuclear

fragments and other cellular debris, and the presence of no organisms other than tubercle bacilli, which were found in only one of the smears examined. Cultures made from the caseous material showed no growth at the end of ten days.

The occurrence of a solitary tubercle, similar to those found in the central nervous system, in the stomach, an organ whose freedom from tuberculosis is remarkable, has not been before recorded. A careful search of the literature has revealed no similar case. Tuberculous ulcers have been described by Hamilton,[1] Blumer,[2] Przewoski,[3] with reviews of the literature; Wilms[4] has reviewed the literature of miliary tuberculosis and has described cases. None of the above observers have considered the tuberculosis of the peritoneum covering the stomach which occurs with every case of tuberculous peritonitis.

The lesions in none of the described cases have been primary in the stomach, but have been accompanied by extensive tuberculosis of other organs, the disease in the stomach being of a comparatively late origin or, in the miliary cases, a part of a general miliary tuberculosis. In these cases the lesion was primary in the submucosa or the peritoneum, or involved the stomach by direct extension, as from a caseous lymph gland. The muscularis was rarely involved and only by extension and not as in this case, was it the primary seat of the disease. In some cases the two forms were combined, an ulcer resulting from the breaking down of a tubercle or tubercles occurring by extension of the process from an ulcer through the lymphatics.

The presence of non-striped muscle completely surrounding the tubercle leaves no doubt as to the primary seat of the disease in the stomach. The question as to where the original focus of infection occurred is difficult to answer. The autopsy revealed no other definitely tuberculous lesion, but the nature of the process, giving rise to the peritonitis, pleuritis and pericarditis, must be considered. The peritonitis suggested, at the autopsy, rather an infection arising from the genitals as the adhesions were most marked in the lower part of the abdomen and in the pelvis. It is well known that a serous membrane tuberculosis may heal and leave no trace of its original nature, but it is doubtful if one so extensive could occur without leaving more evidence of its existence. The lymph glands throw no light on the subject, as they showed no evidence of tuberculosis at the time of the autopsy. The age of the patient and the low virulence of the bacilli isolated show that the process was an extremely chronic one.

The similarity of this case to those of the rare so-called simple abscess of the stomach, recorded in the literature as having been found at autopsy,[5] is striking and a more careful microscopical and bacteriological examination may in future show certain of them to be tuberculous.

Clinically the case is of little interest, as the condition gave rise to no symptoms during life. Had the tubercle been situated in any other position than under the costal margin, a careful examination would probably have revealed the tumor, as it could be readily palpated through the stomach wall at the autopsy.

Conclusions.—(1) The case is one of solitary tubercle in the muscularis of the stomach in which tubercle bacilli were found in the tissues and recovered from an experimental animal with the production of the typical lesions of tuberculosis.

(2) It is impossible to state whether the lesion was primary in the stomach, but there is no definite evidence to the contrary.

Literature.

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THE CONTROL OF HEMORRHAGE FOLLOWING PELVIC OPERATIONS BY PACKING THE PELVIS WITH GAUZE THROUGH A PROCTOSCOPE AND MAINTAINING COUNTER PRESSURE BY PACKING THE VAGINA.

By John A. Sampson, M. D.,

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The following cases, I think, serve to bring out certain important features in the control of hemorrhage following operations in the pelvis. In many instances there is very little opportunity for post-operative hemorrhage, as when the larger vessels have been dissected out and ligated separately and during the operation there has not been any difficulty in controlling all oozing by means of ligatures. On the other hand, there are cases where the control of the bleeding is more difficult, as where the uterine or ovarian vessels are tied in a mass of tissue, on account of the invasion of these parts by an inflammatory process, or the development of an ovarian cyst or a myoma in the broad ligament may displace these vessels so as to render their control difficult.

Usually the uterine and ovarian vessels can be satisfactorily ligated, and the surgeon can reassure himself that whatever the source of the trouble may be, it is not from these vessels,

for the most important aid in the diagnosis or location of the cause of any post-operative complication is the knowledge of the possibility of such a complication arising, from certain things which occurred during the operation.

The control of oozing from raw areas is sometimes very troublesome, as for example in the raw area on the side of the pelvis caused by the removal of an adherent tubo-ovarian inflammatory mass. Here the operator realizes that sutures is more difficult, for the blood wells up from the bottom of the pelvis, obscuring the field of operation, and one can control it only by firm pressure. Any attempt at clamping is done blindly and associated with the danger of tearing the vein and so increasing the hemorrhage or of injuring neighboring structures. The passing of sutures by means of a needle is also dangerous, as the vein may be torn, other vessels injured, or large nerves or the ureter included in the

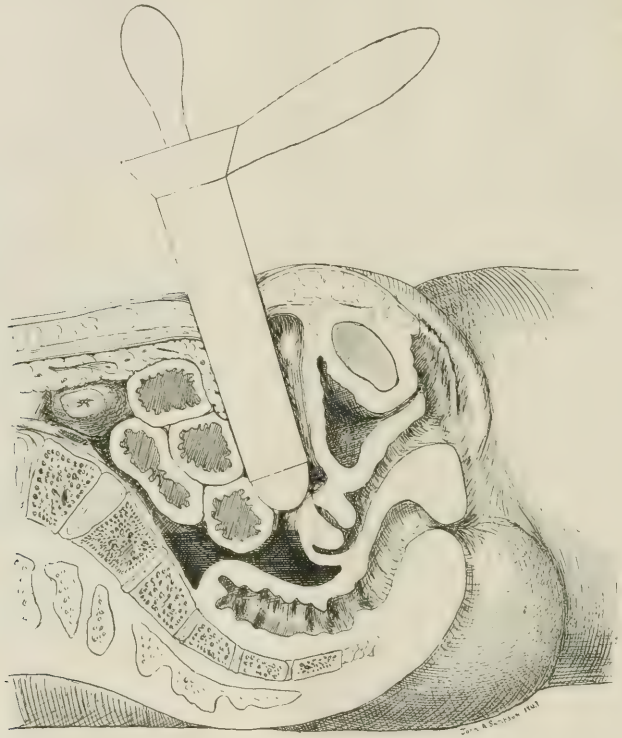


FIG. 1.—INTRODUCTION OF THE PROCTOSCOPE INTO THE PELVIS.

The lower end of the abdominal incision has been opened, and the proctoscope has been inserted through the opening into the abdominal cavity, taking care to direct the end well forward against the bladder, so that the coils of the intestines will be displaced backwards.

In this instance the uterus with appendages have been removed, leaving in the cervix. By removing the obturator the various portions of the pelvis may be inspected, and here one can see that there is a small accumulation of fluid in the pelvis.

passed by means of a needle may injure the ureter or by pricking large vessels may only increase the hemorrhage already present. In many instances his only resource is to pack tightly with gauze.

The most difficult hemorrhage to control is from the large pelvic veins. One can usually see a cut or injured artery, because the blood spurts from it and so the artery can be readily located and clamped and a free ligature placed about it. On the other hand, the localization of an injured vein ligature. In some instances pressure may be made over the bleeding area until the hemorrhage ceases and then gradually released and the vein clamped and a suture placed about it or a needle carefully passed around the vein, or the vein may be compressed by a ligature which has been passed through a mass of tissue surrounding the vessel. In other cases the only means available is to pack tightly with gauze.

During the last four months I have seen two cases of post-operative hemorrhage, where interference seemed to be indi-

cated. Both patients were very ill. The removal of either of them to the operating room and the shock attendant upon the use of an anesthetic, reopening the abdominal incision and repacking the pelvis, would have been attended with great risk. Yet both of these patients recovered and the hemorrhage was controlled by means of gauze packed into the pelvis through a proctoscope. A tight abdominal bandage was put on, and in one instance counter pressure was obtained by packing the vagina with gauze, and a pad was placed over the perineum and held tightly in place by means of a perineal strap.

In a third case, post-operative hemorrhage was excluded by opening the lower end of the abdominal incision and inserting a proctoscope, and thus the pelvis and field of operation were examined. In a fourth case a severe hemorrhage occurring on the eighth day from an amputation of the cervix, was controlled by packing the vagina.

CASES.

Case I.—Miss A. R., white; age 22. Gyn. No. 10508.

Diagnosis.—Double salpingitis, with general pelvic adhesions.

The adhesions between uterus, appendages and other pelvic structures were very dense, so that freeing and removal of the tubes and ovaries caused much oozing. This was controlled by sutures where possible, and two gauze drains were placed in the pelvis on either side of the uterus and the ends of these were brought out at the lower end of the abdominal incision.

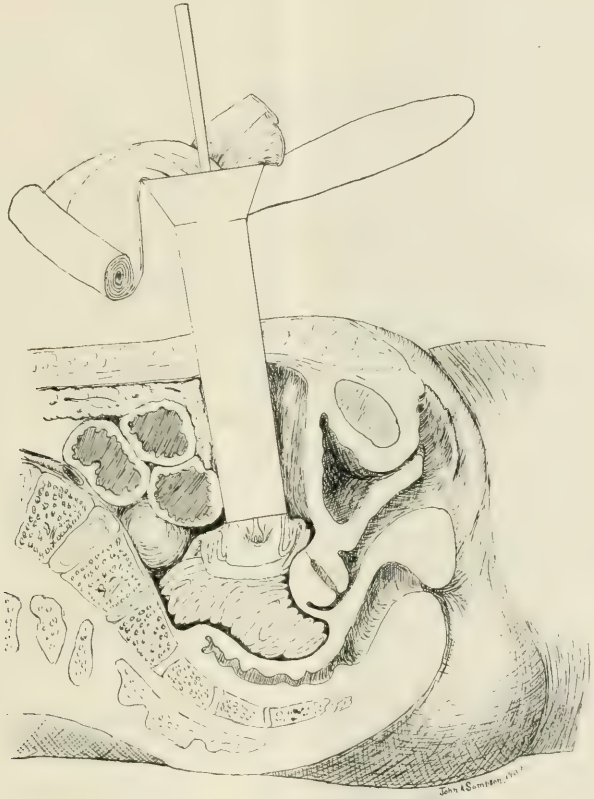


FIG. 2.—PACKING THE PELVIS THROUGH A PROCTOSCOPE.

The gauze may be packed through the proctoscope, beginning at the bottom of the pelvis and moving the end of the proctoscope from side to side, as one pushes the gauze through and gradually withdrawing the instrument as the pelvis becomes filled. The last portion of the drain should not be pushed through the proctoscope, but should be held back and should another drain be necessary it can be pushed in alongside of the first one, as shown above. The lumen of the proctoscope is sufficiently large to hold several drains, but should it become filled and more gauze be necessary, the proctoscope may be removed and reinserted and the packing continued as in the first instance.

Post-operative Condition.—At the close of the operation the pulse was 170; general condition was bad. In half an hour the pulse dropped to 124 and the patient seemed better. Patient's condition remained about the same for the first four hours following operation. During the next two hours her pulse rose gradually from 124 to 160, becoming scarcely perceptible. Extremities were cold, and the patient was very restless. The abdominal dressings became soaked through with a bloody discharge within the first four hours. These were removed and fresh ones were placed over the abdominal incision, which soon became saturated with bright red blood. From the above post-operative hemorrhage seemed evident.

Treatment.—Patient was too ill to endure a second operation. A small proctoscope was sterilized by boiling, then inserted in the lower angle of the abdominal incision and gently pushed down into the pelvis to one side of the uterus, alongside of the drain which had been put in at the operation. The obturator was removed and gauze was packed through the proctoscope into the pelvis, the proctoscope being removed as this part of the pelvis became filled with gauze. The proctoscope was now removed and reinserted into the pelvis at the other side of the uterus and gauze was again packed into the portion of the pelvis exposed by the proctoscope. A pad was placed over the lower portion of the abdomen and a Scultetus bandage was put on very tightly.

The hemorrhage was controlled as was shown by the gradual improvement in the patient's condition and by the marked diminution in the discharge on the abdominal dressings.

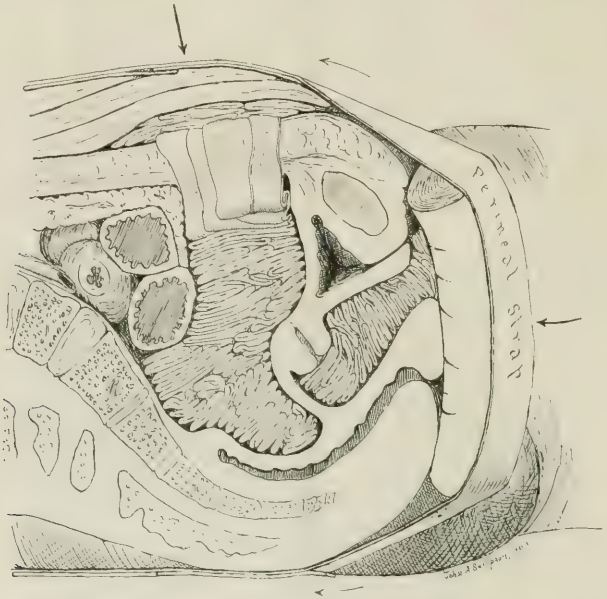


Fig. 3.—Both Pelvis and Vagina have been packed with Gauze, and by Means of Suitable Pads and a Tight Bandage the Pads are held Firmly in Position.

The pelvis has been packed with gauze drains, whose ends emerge at the lower end of the abdominal incision. Gauze pads have been placed over the abdomen and these are held in place by a Scultetus bandage which has been put on tightly. The vagina has been packed with gauze in such a manner as to elevate the cervix, thereby lessening any bleeding from the uterine and cervical arteries. The vaginal pack is maintained in place and the pelvic floor is supported by a roller bandage which has been placed against the perineum and held there by a perineal strap, which coming from the posterior portion of the bandage is drawn tightly over the perineum and fastened to the bandage over the anterior abdominal wall. Thus the pelvis and vagina are not only packed with gauze but pressure is maintained by the tight abdominal binder holding the pads in position and counter pressure by the perineal strap holding the roller bandage against the perineum.

Result.—Recovery.

The removal of the packing was gradually done after the fourth day, all being removed by the eighth day.

Case II.—Mrs. L. T., colored; age 43. Gyn. No. 10591.

Diagnosis.—Multinodular myomatous uterus; Pyosalpinx, right; Tubo-ovarian abscess, left.

Operation, July 6, 1903.—Hystero-myo-salpingo-oöphorectomy (bisection of the uterus).

The uterus was bisected, the right half removed first and then the left.

The oozing from the cervical stump was very free as well as from the raw areas caused by freeing the adherent appen-

dages. On the left side it was found to be impossible to remove the entire wall of the abscess, consequently a portion of it was left in. Six gauze drains were placed in the pelvis, the ends of which extended out through the lower angle of the abdominal incision. During the operation the patient received a subcutaneous infusion of normal saline solution of 700 cc.

Post-operative Condition.—At the close of the operation the pulse was 136. General condition poor.

Condition remained about the same for the first two hours, then the pulse gradually became more rapid, reaching 150 four hours after operation, and at the same time it became poorer in quality and irregular. The abdominal dressings were changed frequently and were found to be saturated with a bright red discharge. Patient was restless, no pain present, extremities were cold.

Treatment.—A small proctoscope was inserted in the lower angle of the abdominal incision and pushed into the pelvis alongside of the drains already present. Through this proctoscope gauze drains were packed into the pelvis as in Case I. Pads were placed over the abdominal incision and the Scultetus bandage was drawn on very tightly. The vagina was packed tightly with gauze and a pad was placed over the perineum and the perineal strap of the Scultetus bandage was drawn tightly over the perineum and fastened to the bandage over the obdominal wall.

The hemorrhage, which probably arose from the cervical stump and raw surfaces caused by the partial removal of the tubo-ovarian abscess, was apparently controlled by this treatment, for the staining of the dressing became less and while the pulse was rapid for several days, the patient's general condition gradually improved.

Result.—Recovery.

The vaginal packs were removed on the fifth day and the abdominal drains were loosened and then gradually removed.

Case III.—Miss M. W., colored; age 37. Gyn. No. 10593.

Diagnosis.—Myoma uteri.

Operation, July 8, 1903.—Hystero-myomectomy.

The ovarian and uterine vessels were tied with silk and the uterus was easily removed and all raw areas were covered over with peritoneum. Pulse was 112 at the close of the operation, and the general condition was excellent.

Post-operative Condition.—Convalescence at first was all that could be desired.

On the morning of the third day, patient became restless. In three hours the pulse rose from 112 to 136. The extremities became cold; general condition poor; temperature 97°.

Treatment.—It was impossible to make a diagnosis. The operation was not difficult and the chance for hemorrhage was very slight.

The gradual increase in the rapidity of the pulse, with the clammy condition of the extremities, suggested hemorrhage. The lower end of the abdominal incision was reopened and a proctoscope inserted through this into the pelvis. The pelvis was exposed and no evidence of hemorrhage found. The pelvis was not packed with gauze, as nothing was found to indicate such measures.

Result.—Patient died. Probable cause of death was heart failure.

Autopsy was not permitted.

Case IV.—Mrs. P. T., white; age 34. Gyn. No. 10522.

Diagnosis.—Myoma in anterior wall of cervix.

Operation, May 30, 1903.—Amputation of the cervix.

A circular amputation of the cervix was done and the vaginal wall was sutured to the cervix with catgut sutures.

Post-operative Condition.—Convalescence uneventful until the morning of the eighth day, when patient stated that she thought she was menstruating, as it was the time for it and she noticed a slight bloody discharge. At 2 P. M. the bleeding was very free, but it lasted for only about twenty minutes and then ceased. At 5 P. M. the patient had another hemorrhage and this time the vagina was packed with gauze. The bleeding so far, while it has been free, had not been sufficiently great to cause any alarm or to have any effect on the patient's condition. Two hours later the patient had another hemorrhage, the vaginal packs were expelled and the patient lay in a pool of blood. Pulse could not be counted and was just palpable at the wrist. The extremities were cold. There was dyspnœa and the patient was so weak she had difficulty in speaking.

Treatment.—The vagina was packed tightly with gauze, care being taken to lift the cervix up and pack first beneath it. Pads were placed over the lower portion of the abdomen and a very tight Scultetus bandage was put on. A firm pad was placed over the perineum and this was held tightly in place by means of a perineal strap fastened to the bandage in front.

Result.—Recovery.

Vaginal packs were removed on the third day.

In addition to the above these patients received subcutaneous infusions of salt solution, were stimulated with digitaline and strychnia and were given morphia when restless.

Method of Packing the Pelvis through a Proctoscope.

1. The lower end of the abdominal incision should be opened sufficiently to admit the proctoscope.

2. The proctoscope, which has been boiled and then dipped in sterile vaseline or oil, should now be pushed through the incision down into the pelvis, as shown in Fig. 1. The instrument is smooth and causes very little pain. The obturator may be removed and various parts of the pelvis may be seen by turning the end of the instrument from side to side. For this purpose reflected light is best, using an artificial light with head or hand mirrors. Should one wish to insert the proctoscope further into the pelvis, it is best to replace the obturator before doing so.

3. The pelvis may now be packed with gauze, as shown in Fig. 2. One can use a long pair of forceps or a packer and by turning the end of the proctoscope from side to side the various portions of the pelvis may be reached, gradually withdrawing the instrument as the pelvis becomes filled. Should

the lumen of the instrument become filled with gauze, thus preventing the insertion of more, the proctoscope should be removed and reinserted, and the packing continued as in the first instance.

4. The ends of the drains or packs should be folded over the incision and covered with gauze pads. The abdominal binder should be drawn on very tightly so as to make pressure over the gauze pack as indicated in Fig. 3.

Method of Packing the Vagina.

Place the forefinger of one hand in the vagina and push the cervix upwards, and pack the gauze in beneath and posterior to the cervix so as to lift the cervix up. This is very important, for by lifting the cervix up bleeding from the cervical and uterine vessels may be greatly lessened. I have frequently noticed that in abdominal operations where a hysterectomy has been done and the cervix has been left in, by drawing the cervical stump upwards bleeding from the cervical vessels or even from the uncontrolled uterine vessels may cease, to commence again as soon as the cervix is released. The same principle should be applied in packing the vagina. The vagina should also be packed very tightly so as to compress the vaginal veins which help to form the utero-vaginal plexus. After packing the vagina a firm pad or roller gauze bandage should be placed over the perineum and firmly held in place by means of a perineal strap (see Fig. 3). Before placing the perineal pad in position and drawing the strap about it, a firm pad should be placed over the lower portion of the abdomen and a tight abdominal bandage should be put on, if this has not already been done. The perineal strap may now be drawn tightly over the perineum and fastened to the abdominal binder, thus holding the gauze in the vagina and maintaining pressure over the perineum. I think that packing the vagina is of great service when the pelvis is packed from above, and likewise that the placing of pads over the lower portion of the abdomen and a tight abdominal binder also aid when the vagina alone is packed.

Advantages of the use of the proctoscope are:

I. Frequently a diagnosis may be made in obscure cases. The lower end of the abdominal incision can be opened easily in the first twenty-four to forty-eight hours and the insertion of a smooth metal instrument like a proctoscope gives rise to but very little pain. The question of the diagnosis of post-operative complications in some instances is easy, but in other cases it is very difficult. Because a patient does badly after one operation it is certainly not a clear indication that she should have another. The rapid pulse may mean broken cardiac compensation, and an elevation of temperature may be a beginning pneumonia; and these conditions could not be benefited by a second operation. On the other hand, should hemorrhage or peritonitis be present they demand immediate attention. By this method one has a means of examining the field of operation without causing the patient much shock or pain.

II. Hemorrhage in certain instances may be controlled as in Cases I and II.

III. The packing of the pelvis with gauze is done through a sterile tube and so there is less danger of carrying in infection, likewise the pain is very little.

IV. The proctoscope has great advantages over the cylindrical packer in use a few years ago. It has an obturator and so can be inserted with ease; it is much larger, thus permitting an inspection of the field of operation and easily permitting the packing of wide strips of gauze, which could not be done in a smaller instrument.

In this hospital we have frequently used the large cystoscopes as a means of introducing gauze into wounds, the principle being the same as that of the cylindrical packer. On May 4, 1903, I had occasion to incise the right kidney of a patient (Gyn. No. 10208) who had come into the hospital complaining of cystitis, and later symptoms of renal obstruction developed. A small stone was found in the pelvis of the kidney and a large amount of purulent urine escaped. The bleeding was very profuse and it was controlled by packing the pelvis of the kidney with gauze. The patient's temperature remained elevated and on the third day I decided to remove the gauze from the kidney, thinking that it might be the cause of the elevation of temperature. Before doing so, I had several large cystoscopes boiled, planning to use them should it be necessary to replace the gauze. On removing the drains a very severe hemorrhage took place, but was soon controlled by gauze packed through a large cystoscope which had a diameter of 1.5 cm. Without a cystoscope the packing of the pelvis of the kidney would have been very difficult and very painful. Pads were placed over the lumbar incision and the patient was placed over a sand bag in such a way as to maintain pressure over the wound.

From the use of large cystoscopes in this and previous cases, it occurred to me that the same principle could be employed in the abdomen, and that one could use proctoscopes and thus inspect the field of operation, and, should it be necessary, pack the pelvis through the instrument.

In order to reach the bottom of the pelvis in most cases, the proctoscope should have a barrel about 18 cm. long and in very fleshy patients, possibly longer. A diameter of 2.5 cm. will be found to be large enough. For other work and where one does not care to reach the bottom of the pelvis, smaller ones may be found very convenient, as one I have used which has a length of 11.5 cm. and a diameter of 1.8 cm.

THE JOHNS HOPKINS HOSPITAL BULLETIN.

The Hospital Bulletin contains details of hospital and dispensary practice, abstracts of papers read, and other proceedings of the Medical Society of the Hospital, reports of lectures, and other matters of general interest in connection with the work of the Hospital. It is issued monthly.

Volume XIII is now completed. The subscription price is $1.00 per year. The set of thirteen volumes will be sold for $32.00.

NOTE ON THE DISCOVERY AND FIRST USE OF THE STOMACH TUBE BY AN AMERICAN PHYSICIAN.[1]

By Julius Friedenwald, M. D.

It is generally believed that two English surgeons, Jukes and Bush, are the inventors of the stomach tube. This claim is based on an article published by Jukes in the London Medical Repository of 1822, an abstract of which is found in the American Medical Recorder of 1823, entitled:

"Description of an apparatus for removing poisons from the Stomach, invented by Mr. Jukes, surgeon."

"We might with justice be considered to be forgetful of the duty we owe the profession, were we to fail in laying before them a description of a very excellent apparatus which Mr. Jukes, its very ingenious inventor, favored us with a sight of. It consists of an elastic gum tube, a quarter of an inch in diameter, and two feet and a half in length, terminating at one extremity in a small globe of ivory, with several perforations; the other extremity is adapted either by screw or by plug (the latter is preferable), to an elastic bottle of sufficient size to contain at least a quart of liquid, and having a stop-cock fitted to it, in a similar manner as in the hydrocele bottle. Instead of the bottle, a pewter syringe, of an equal capacity, may be adapted, in the same manner, to the flexible tube. The operation by the syringe is performed more quickly, and may therefore, perhaps, be preferred by some. In cases where surgeons have neither bottle nor syringe, the tube alone might be made to answer the purpose, if the operator apply his mouth to the extremity, and thereby institute the office of a siphon."

"Application.—The patient ought to be placed on the left side, and the globulated end of the tube be then carefully passed to the greater curvature of the stomach, either through the mouth or nostril, as may be thought proper. Having previously filled the bottle or syringe with warm water, at the temperature of 150°, screw or plug it to the tube, turn the stop-cock, and gently force the contents into the stomach. The then diluted contents are to be immediately withdrawn by pulling up the piston; or, if the bottle be applied, the same effect will ensue from its elasticity enabling it to recover its original form, by which the fluid contents will return, charged with the poison. This operation ought to be repeated, till the water, which is withdrawn, becomes clear and tasteless."

"In Mr. Jukes' experiments, first on dogs, and then on himself and others, assisted by Mr. James Scott, Surgeon in Westminster, the apparatus was proved fully to answer the intended purpose. In these experiments, Mr. Jukes swallowed, first, two drachms of laudanum; he afterwards gradually increased the quantity, until it reached ten drachms; since which, he has administered to several individuals (one of them a female) one ounce of laudanum, with an equally successful result. The utility of so well contrived an instrument, arising especially from its being equally adapted to the removal of all the more bulky poisons, must be evident to every one. We consider that Mr. Jukes has rendered an essential service to the profession, and to the community, by its invention."

That the credit of this discovery is due Dr. Physick there can be no doubt. Physick published his original paper October, 1812, in The Eclectic Repertory, Vol. III, page 111, under the title of "Account of a new Mode of extracting Poisonous Substances from the Stomach. By Philip S. Physick, M. D., Professor of Surgery in the University of Pennsylvania," which is ten years prior to the appearance of Jukes' article. The paper reads thus:

"On Thursday 6th June, 1812, I was sent for in much haste at nine o'clock in the evening, to visit two children of Mr. S. B. each three months old. They were twins, and had been affected with hooping cough for several weeks. The mother informed me that in consequence of her children having been very restless the night before, she had this evening given them some laudanum. To William she had given one drop at seven o'clock, and the same dose to Edmund forty minutes afterwards."

"I found William in a state of stupor or very profound sleep, from which he could not be roused, and was informed, that just before my arrival, his whole body had been strongly convulsed; his breathing was laborious and his pulse feeble and slow. On inquiry, I found that vial out of which the drop of laudanum had been given, had contained, several weeks before, nearly one ounce of that medicine, but having been left without a cork, it had dried away so much that one drop only could be obtained for William; in order to procure another drop, two drops of water had been put into the vial and stirred about, by which another drop had been obtained and given to Edmund, forty minutes having intervened between the two doses."

"About a quarter of an hour before my visit, the mother had given to William fifteen drops of antimonial wine, but as it had produced no effect I prescribed an emetic of ipecacuanha, and directed it to be given immediately; this however was found impracticable, as the child was incapable of swallowing."

"At half past nine o'clock, Edmund, who had appeared to be in a very easy sleep, became convulsed, and his pulse and breathing were affected in the same way that his brother's had been. We attempted to give him ipecacuanha, but could not make him swallow it. The countenances of the children became livid—their breathing very laborious; with long inter-

[1] Read at the Johns Hopkins Historical Club, March 9, 1903.

vals between the times of each inspiration, and the pulse in each very feeble."

"Under these circumstances it clearly appeared no time was to be lost, and therefore, as they could not swallow any thing, I determined to inject an emetic into their stomachs. For this purpose a large flexible catheter was passed through the mouth down the œsophagus into the stomach, and through this, one drachm of ipecacuanha mixed with water was quickly injected by means of a common pewter syringe. In hopes that the emetic would operate, I waited some time without any effect being produced. William exhibited now every symptom of speedy dissolution,—his face became very livid,—his pulse and respiration had almost ceased; and indeed the pulse could not be perceived, except a faint stroke or two, after that kind of imperfect and convulsive inspiration which is commonly observed in children just before actual death, accompanied with a convulsed action of the muscles of the mouth and neck. In this situation I passed the catheter again, and by applying the syringe to its projecting end, drew up the fluid contents of the stomach, and immediately injected warm water which was again withdrawn. These operations were alternated two or three times, but when completed no sign of life remained. Hopeless as the case now appeared, I injected some spirit and water mixed with a little vinegar through the catheter;—in less than one minute the child again inspired, the pulse became perceptible at the wrist, and in four minutes, with the aid of external stimuli, both went on so perfectly that there was every reason to believe the child would recover. By the time that these operations were performed on William, Edmund was observed to have passed into the same condition of apparent death, from which his brother had just recovered. The same measures were adopted in his case, and with the same happy effect. I now flattered myself that the children would do well, but in this expectation I was disappointed. In about half an hour, Edmund's breathing became very slow and laborious, and his pulse which had before been very much excited became so feeble, that he appeared to be sinking very fast. Supposing that the effects observed, might be produced by the spirit which had been given occasioning intoxication, I determined to extract it from the stomach and to inject warm water, removing it again. This operation was very quickly performed, but at the conclusion of it I was much distressed by seeing the little patient to all appearance lifeless. Observing in this case, that the actions of life ceased so immediately after the extraction of the spirit, I determined to try it again, and injected a little weak brandy and water. In less than a minute this occasioned a repetition of breathing and of the action of the heart, and in about five minutes both were regularly performed. The symptoms of ebriety took place also in William, but observing that his brother had been nearly lost by extracting the spirit from his stomach, I did not attempt the removal of it in William's case. Doctor Austin who kindly assisted me on this occasion, remained all night with my patients. He informed me, that after some time they became better, through the night. Their bowels were moved several times by castor oil. After five O'clock in the morning Edmund had no convulsions, but they continued with William until twenty-five minutes after nine, when he struggled a little, sighed, and expired. Edmund was troubled for two or three days with a diarrhœa but soon recovered completely."

"The idea of washing out the stomach with a syringe and tube, in cases where large quantities of laudanum or other poisons had been swallowed, occurred to me at least twelve years ago, and I have constantly, for many years, recommended it in my lectures. In the year 1809, Dr. Dorsey performed the operation of washing out the stomach in such a case, but the patient had taken the poison twelve hours before he was called, so that he did not succeed."

Of interest in this connection is a letter published by Physick in the same volume of The Eclectic Repertory, page 380.

"*To the Editors of the Repertory.*

"When I sent you the communication published in the first number of the third volume of the Electic Repertory, descriptive of what I supposed a new method of extracting poisons from the stomach, I was influenced by a desire to propose to my medical brethren a method of treatment which might preserve the lives of many unhappy persons who either by design or accident had swallowed large doses of laudanum or other poisonous substances. If in a single instance I had been instrumental in preventing death, I should have considered myself very happy; and to have withheld a communication which might have been attended with such beneficial effects, would have been in every respect unjustifiable."

"I have the pleasure of announcing to you and to your readers, that in several instances which have recently occurred in this city, the practice has been completely successful. In two cases treated by Dr. Dorsey, in which large quantities of laudanum had been taken, there is great reason to believe that no other mode of treatment would have succeeded in preventing the fatal event. Both patients were saved by injecting warm water into their stomachs, and extracting it again, together with the laudanum, by means of a syringe. I therefore am happy in having called the attention of the profession to a mode of treatment not before used in this country, at least within my knowledge; but I have now an act of justice to perform, in ascribing the merit of the invention to Dr. Alexander Monro, junior, of Edinburgh, who published it in his inaugural thesis, in A. D. 1797. Of this circumstance I was entirely ignorant when I sent you my paper, and probably should still have remained so, had it not been mentioned in his book of Morbid Anatomy, a work which has but very lately come into my hands."

PHILIP SYNG PHYSICK.

Philadelphia, 20th January, 1813.

That the credit of this invention is due Physick is also shown by Mathews in the Medical Recorder, Vol. X, 1826, page 325, in an article entitled, "Description of an Improved Instrument, for Extracting Poison from the Stomach; with some Statements Tending to Establish the Validity of Dr. Physick's Title to the Credit of having Invented the Stomach Tube."

"It appears that Dr. Alexander Monro, Jr., in his inaugural thesis, published 1797, suggests the use of a tube and syringe, as a suitable means for extracting poison from the stomach, it does not appear, however, that he ever employed

them. About that period, the same plan occurred to Dr. Physick, without having met with the suggestion of Dr. Monro, to whom, however, he subsequently yielded the merit of having made this plan public previous to himself. In the year 1800, Dr. Physick was called to the surgical chair in the University of Pennsylvania, and continued, from that time forward, to inculcate this among other useful inventions with which he has enriched our art, to numerous classes of students, who now constitute a considerable portion of the physicians throughout the union; in proof of this we annex the following certificates, obtained from highly respectable practitioners of this city on another occasion, in order to support Dr. Physick's claim against that of Dr. Thomas Ewell, of the city of Washington, who had the justice to publicly acknowledge Dr. Physick's title upon perusing them. His claim was grounded on his having published, in the Medical Repository, of New York, in the year 1808, a paper 'containing a proposition to relieve the stomach from poison by the use of a catheter.'"

No. 1.

"I do hereby certify, that in the years 1802, 3 and 4, I attended Dr. Physick's lectures upon surgery, and heard him recommend the introduction of a tube into the stomach, in cases where poisonous substances had been taken, through which tube, fluid might be injected by a syringe and extracted again; thereby enabling the practitioner to remove such noxious substances from that organ.

Signed, Philadelphia, June, 1820,

Isaac Cleaver."

No. 2.

"I do hereby certify, that I attended Dr. P. S. Physick's lectures on surgery, in the years 1805, 6 and 7, that, in these lectures, the Doctor exhibited a tube coated with elastic gum, brought by Dr. Dorsey from Paris, and made there by Dr. Physick's order, long enough to reach from the mouth into the stomach. With such a tube, Dr. Physick advised to inject water or other fluids into the stomach, and draw them back again by the aid of a syringe, in cases where laudanum or other poisons had been swallowed, and thereby to work them out of the stomach and introduce counter agents.

Signed, Philadelphia, June, 1820,

John D. Thomas."

No. 3.

"I remember that, in the winter of 1808-9, Dr. Physick informed me that he had an elastic tube, brought from Europe by Dr. Dorsey, for the purpose of injecting fluid into the stomach, and drawing it out again, in order to wash out poisonous substances, such as opium, &c.

Signed, Philadelphia, June, 1820,

Benjamin S. Jenny."

"In the year 1803, Dr. Dorsey was in Paris, and had made, by Dr. Physick's order, a tube of the kind now generally used, constituted of the same materials as the French catheter, and resembling it, except in size. That the use for which it was designed was unknown in Paris previous to that period, is evident from a letter from Dr. Dorsey to Dr. Physick, dated 1803, and now in the possession of the latter, in which he states that the makers were curious to know what was the intention of so large a catheter. It was not long before they ascertained the point, and tubes have been since regularly imported from there, for the supply of physicians in the United States.

"In the year 1809, Dr. Dorsey employed the instrument, but unsuccessfully, as the patient died, owing to twelve hours having elapsed before his arrival. In 1812, Dr. Physick had an opportunity of employing it in a case of twins, to whom the parent had given too much laudanum, one of them died, the other recovered. This case was published in the Eclectic Repertory for October, 1812, and has been republished in the second number of the Medical Recorder for 1823. Since that period, it has proved successful in a great many instances, and has become so common a mode of removing poison from the stomach that almost every physician, even in the country, is furnished with a tube and syringe for that purpose.

"With a knowledge of the foregoing facts, our surprise may readily be conceived, when we heard of the invention being announced in the London Medical Repository for October, 1822, as of recent origin, and claimed for Mr. Jukes, of Westminster. And, also, in the London Medical and Physical Journal, for that year, a description of his method by himself, and another modification by Mr. F. Bush, surgeon of Frome, who also claims the honor of the invention. Mr. Bush's mode, is the same as that invented by Dr. Physick, nineteen years before; namely, a tube and syringe. That of Mr. Jukes differs in having an elastic gum bottle, to supply the place of the syringe, which we think no improvement; and his tubes are furnished at the end with an ivory ball perforated with holes, which will be found rather disadvantageous than otherwise, more especially as it is often necessary to pass the instrument through the nose into the stomach, in consequence of the patient proving refractory, and holding the mouth firmly closed, which would be impossible with the ivory ball affixed."

"From the foregoing statement, it will be admitted by every candid individual, that the merit of the invention, is strictly due to Dr. Physick. It will also be perceived, that he was the first to carry it into successful operation."

Dr. Saml. Jackson corroborates this statement in an article in the American Medical Recorder, 1823, referring to Mr. Jukes' work he says, "Whether the early volumes of the Eclectic Repertory ever reached the metropolis of England is rendered doubtful since we find, from the last numbers of the Medical Recorder and of the Journal of Foreign Medical Science, that some of the writers of that city have claimed the invention of a new method of washing and extracting poisons from the stomach, by means of a tube and syringe, for their fellow citizen Mr. Jukes. 'We might with justice,' say they, 'be considered as forgetful of the duty we owe the profession, were we to fail in laying before them a description of a very excellent apparatus which Mr. Jukes, its very ingenious inventor, favored us with a sight of.'"

"We are entirely willing to grant Mr. Jukes all the credit the journalists would claim for him or he claim himself, as the same thought might have occurred to many ingenious men, who were seriously engaged in relieving the distresses of

suffering humanity. But the priority of discovery and the demonstration of its great utility must certainly be awarded to our countryman, Dr. Physick.

"I well remember the satisfaction that Dr. Physick's operation afforded in Philadelphia, and that the invention of it was cordially ascribed to himself. But now, after a lapse of ten years, we find it claimed by the editors of the London Medical Repository for Mr. Jukes, surgeon in Westminster. How much was I surprised in reading their account of it when, at the same time, I could look over my shoulder to a box containing a large syringe with Dr. Physick's elastic tube, two feet long and a half inch in diameter, an apparatus that has occupied that station for the last nine years. It is true that our American tubes are not tipt with an ivory globe, an addition which I cannot but consider as wholly useless."

There can be no doubt from the foregoing that Dr. Physick used the tube as early as 1800 and that he recommended it for many years in his lectures to his students; that by his advice his nephew Dorsey had stomach tubes made in Paris as early as 1803 and employed the tube unsuccessfully in a poisoning case in 1809; and that in 1812 Physick published the report of successful results with its use in cases of poisoning. The work of Jukes first appeared in 1823; there can therefore be no doubt but that Physick was the inventor of the stomach tube and was the first to make practical application of this instrument.

(NOTE.—The reference made by Dr. Physick and others to the invention of the stomach tube by Alexander Monro, Jr., refers to Monro's Inaugural Thesis, published in 1799. Monro merely suggests the use of the tube in cases of poisoning for the extraction of the poison from the stomach and for the introduction of food into the stomach in cases of dysphagia and for extracting gases and food from the stomach in cases of gastric fermentation in cattle. He does not point out, however, that any practical application of the tube was made in cases of poisoning.)

ON A RAPID METHOD OF STAINING NEUROGLIA.

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(*From the Pathological Laboratory of the Johns Hopkins University and Hospital.*)

The methods of staining neuroglia in common use have the drawback that the tissue requires special mordanting for a considerable period of time. In most instances the fresh tissue or the tissue after a short period of fixation has to be used. This renders the methods inapplicable to tissues which have not been specially prepared. The well known methods of Weigert (1), Mallory (2) and Benda (3) are all open to this objection. The tissue in these methods is prepared in bulk and the sections cut from the specially mordanted tissue. The mordant does not appear to have been applied to the cut sections.

The mordants used by Mallory in his method, with slight modification, can be so used, but the stain recommended by him does not give as good results as others. The tissue when mordanted in bulk requires eight days, but this can be shortened to a few minutes by applying it directly to the section. The gentian violet solution of Mallory was first used. The two constituents of gentian violet, methyl violet and crystal violet, were then in turn substituted. While all produced fairly good results, the crystal violet stained most intensely. This stain has been recommended by Benda (3) as the most desirable in one of his methods.

The tissue, obtained preferably within a few hours of death, should be fixed in a 10 per cent solution of formalin (4 per cent formaldehyde). Small pieces give the best results. The entire brain and cord may, however, be hardened without cutting and still give good results. If the fixation has not been thorough the outer part will give a differential stain while the inner part of the tissue will not.

The stain, like all the differential neuroglia stains, will stain fibrin. This, however, will only in rare instances cause difficulty. The results were controlled by staining pieces of the same tissue after proper fixation and mordanting by the methods above mentioned, by the special connective-tissue stains of Ribbert and Mallory and the fibrin stain of Weigert. In every instance that a good preparation with the special neuroglia stains was obtained the stain was successful. Tissue which had been preserved in formalin for six months gave good results.

The neuroglia nuclei and their chromatin and the neuroglia fibres stain a light violet color; the nucleoli of nerve cells and of the endothelium lining the capillaries a similar color. The protoplasm of certain neuroglia cells stains a faint violet color. Many fibres could be seen as processes of these cells. In certain imperfectly differentiated specimens a number of coarse connective-tissue fibres were stained a pale reddish-violet color. The stain would not stain connective tissue in sections from other organs. The method will give fair results on tissue fixed in alcohol but it is uncertain.

The method, while possessing many of the faults of the other methods, has the advantages over the original method of Mallory that it can be applied to any formalin fixed tissue without prolonged special preparation and requires only a few minutes to complete.

Weber (4) calls attention to the great variation in the staining of neuroglia even when attempted under the most favorable circumstances. Whether this stain will ultimately prove to have the same variability cannot be stated.

Steps in the Process.

1. Fix in 10 per cent formalin (4 per cent formaldehyde). The tissue should be obtained within 10 hours of death and fixed, preferably in small pieces.
2. Embed in paraffin (preferably the anilin oil method).
3. Cut 5-15 micra sections and mount on slides in the usual way.
4. Remove the paraffin by means of xylol, absolute alcohol and 95 per cent alcohol.
5. Cover the section with a saturated aqueous solution of picric acid for two minutes. The section should be of a deep yellow color.
6. Wash in water.
7. Cover the section with a 10 per cent aqueous solution of ammonium bichromate for two minutes. The yellow color should be completely removed. If not, repeat.
8. Wash in water.
9. Stain five minutes in

Crystal violet saturated solution in alcohol (95 per cent)	8 cc.
Anilin oil water made by shaking 5 cc. of anilin oil with 95 cc. of distilled water and filtering	42 cc.

This solution should be freshly prepared. A similar solution of either gentian violet or methyl violet may be used but the stain is not so intense.

10. Wash in water and blot.
11. Cover a 5 per cent solution of potassium iodide which has been saturated with iodine, one minute.
12. Wash with water and blot until the section is dry. If all the water is not removed the differentiation will be imperfect in the portions containing water.
13. Differentiate in anilin oil and xylol, equal parts.
14. Wash thoroughly in xylol.
15. Mount in balsam.

The sections if not exposed to light will keep well. The portions of the section where the neuroglia is abundant are of a deep violet color. The rest of the section is nearly colorless. The method is based on that of Mallory.

References.

1. Weigert: Beiträge zur Kenntnis der normalen menschlichen Neuroglia. Frankfurt a. m. 1895.
2. Mallory: On certain improvements in histological technique. Jour. of Experiment. Med. 1897, II, p. 532.
3. Benda: Neurologisches Centralb. 1900, S. 786.
4. Weber: Die heutige Stand. der Neurogliafrage Centralb. f. Path. 1903, No. 1.

NOTES ON NEW BOOKS.

Diseases of the Liver, Pancreas and Suprarenal Capsules. By L. Oser, M. D., E. Neusser, M. D., H. Quincke, M. D., and G. Hoppe-Seyler, M. D. Nothnagel's Encyclopedia of Practical Medicine, American Edition, translated under the editorial supervision of Alfred Stengel, M. D. Edited with additions by Reginald H. Fitz, M. D., and Frederick A. Packard, M. D. (*Philadelphia, New York and London: W. B. Saunders & Co., 1903.*)

In one volume are the comprehensive treatises of Oser on diseases of the pancreas, of Neusser on diseases of the suprarenal capsules, and of Quincke and G. Hoppe-Seyler on the diseases of the liver. Rarely do such laborious reviews of current medical knowledge appear in any other than the German language. The value of Nothnagel's series being fully recognized, it is of special interest to know how well the American editors have fulfilled the task of translation. By addition to the text they have, moreover, attempted to fill the interval which now exists between the German edition published in 1898 and the present translated edition of 1903. The volume is well translated and carefully edited. Though additions to the text are often from necessity abruptly introduced and at times too brief to give a comprehensive view of the subjects treated, the editorial supervision of such recognized authorities as Dr. Fitz and Dr. Packard has added materially to the value of the work.

Comparison of Oser's article on diseases of the pancreas with that of Friedreich, which appeared about twenty-five years ago in von Ziemssen's Encyclopedia of Medicine, and presented a careful summary of the facts then available, will show how extensive is the literature of pancreatic diseases accumulated in the intervening period. The important contributions of von Mering and Minkowski have since appeared and, as Oser mentions in his preface, great impulse has been given to interest in the subject by American physicians, especially through the brilliant work of Fitz and Senn. As an introduction to Oser's monograph, Prof. Zuckerkandl has written a description of the anatomy of the gland. Here as elsewhere in the work scant attention is given to the histological peculiarities of the gland; the editor has, however, added a description of the islands of Langerhans and in the appropriate places has inserted notes in considerable detail upon their relation to carbohydrate metabolism and to diabetes mellitus. The very important investigations of Pawlow have not been noted in the revised edition. Oser has attempted to distinguish between hæmorrhage into the pancreas and hæmorrhagic pancreatitis, and though separate sections are devoted to the two conditions, symptoms of hæmorrhagic inflammation are described in the chapter on simple hæmorrhage. In a brief note the editor has more clearly than the author stated the relation of fat necrosis and its treatment to pancreatic lesions. The bibliography appended to Oser's work has been much enlarged by the editors and occupies thirty-two pages.

Diseases of the adrenals are introduced by a review of the often discordant results of investigations into the physiology and the chemistry of the gland. A summary of the observations of Prof. Abel is appended to the text; the editor accepts the conclusions of Prof. Abel and believes that he has maintained the identity of epinephrin as the constituent of the gland which raises blood pressure. Hay fever and other diseases of the nose and throat in the treatment of which advantage has been taken of the vasoconstrictor action of suprarenal extract are cited by the editor and its employment as a hæmostatic applied locally or administered internally is described. The greater part of the monograph on the adrenal is given to Addison's disease, which in every case the author thinks results from an impairment or complete suppression of the functions of the adrenal capsule, brought about by disease of the capsules themselves or of the nerve tracts con-

trolling their activity. The administration of suprarenal extracts according to the author has been followed by little or no improvement in Addison's disease and in the recent literature cited by the editor no more conclusive results are noted.

More than one-half of the volume is devoted to the diseases of the liver; since our knowledge of the organ has within recent years remained somewhat stationary the treatise excites somewhat less interest than the preceding chapters, and though numerous additions have been made by the editor, these are necessarily briefer and less important than those previously mentioned. Of much value is the introduction dealing with the general pathology and physiology of the organ, since it constitutes an authoritative summary of our knowledge upon these obscure subjects. The various forms of jaundice receive detailed consideration. The article on cholelithiasis written by Hoppe-Seyler is introduced by a historical review and concludes with a section on treatment in which both medical and surgical methods are discussed. Surgical interference is recommended in those cases where internal medication is without avail and when, despite remedial measures, attacks of gall-stone colic recur and undermine the strength of the patient. In view of facts which have been confirmed by abundant observation, the sections dealing with the cause of hepatic abscess and its relation to dysentery are unsatisfactory. Neither in the original text nor in the editorial additions does the Amœba coli receive the attention which it deserves. In an editorial appendix to the section on treatment of hepatic cirrhosis, Dr. Packard reviews the results of operative interference and reaches the conclusion that the results, on the whole, have been encouraging and even as a last resort more beneficial than the less active medical treatment.

It is needless to say that the volume throughout is of very great value. Like other parts of the same series it aims to review the relation of medical practice to normal and pathological physiology and its copious bibliography makes the literature of each subject available.

A Laboratory Handbook of Physiologic Chemistry and Urine-examination. By Charles G. L. Wolf, M. D., Instructor in Physiologic Chemistry, Cornell University Medical College, New York. 12mo volume of 190 pages, fully illustrated. Cloth, $1.25 net. (*Philadelphia and London: W. B. Saunders & Co., 1903.*)

"The object of this book is to supply to students and practitioners of medicine a guide to a course in physiologic chemistry and the examination of the urine and the contents of the stomach. The first part of the book is taken up with simple exercises in physiologic chemistry, which will give an elementary insight into the chemical side of physiologic processes."

"In the part of the book which deals with the urine and the gastric contents, no tests have been given which do not rest on a good chemical foundation. The aim has been to give as few tests as possible, and these to be chosen for their suitability to purely clinical needs. No operations are described which have not undergone a thorough trial with students in the laboratory."

The title on the cover is somewhat misleading. It reads: "Physiologic Chemistry and Urine Examination." On the title page this is changed into "A Laboratory Handbook of Urine Analysis and Physiologic Chemistry." This title indicates better the general aim of the book, although a perusal of its pages indicates that the author intended it to be more than a mere laboratory guide. The experiments in each topic are preceded by a discussion of the physiological properties of the substances included in the topic. These discussions undoubtedly will serve to keep up the interest of the student in the work he is performing in the laboratory. But on the other hand, on account of the nature of the book, these discussions must necessarily be brief and dogmatic. Brevity and dogmatism are very apt to allow of errors in statement. These, it is true, are not very frequent. What is more to be feared is error in interpretation. This we fear may lead to trouble. The book has an air of completeness about it and the student will be very apt to use it as his main, if not his only, guide to physiological chemistry. In such a case physiological chemistry would not receive the deference which it deserves. However, if combined with the use of some other more complete text-book or with a course of systematic lectures, the book will undoubtedly prove valuable to the student and helpful to the teacher.

Physical Diagnosis. Diseases of the Thoracic and Abdominal Organs. A Manual for Students and Physicians. By Egbert Lefevre, M. D., Professor of Clinical Medicine and Associate Professor of Therapeutics in the University and Bellevue Hospital Medical College; Attending Physician to Bellevue and St. Luke's Hospitals, etc. Illustrated with 74 engravings and 12 monochrome plates. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

So many works on physical diagnosis have appeared within the last few years that the medical student has the utmost difficulty in deciding on a choice, and the instructor has almost equal difficulty in recommending what text-book he should select.

This volume, with 448 pages, is entirely devoted to the physical examination of the thoracic and abdominal viscera in health and disease. The physics of the various cardiac and respiratory phenomena, both normal and abnormal, are given rather more fully than is generally the case in a book of this dimension. This is due, the author states, to the fact that physical diagnosis is taught earlier in the medical course than was the case a decade ago. His explanations of the phenomena are on the whole satisfactory and those usually accepted. The methods of the physical examination of the nervous system are not taken up. In a book of this size the author is wise not to have attempted an account, even a brief one, of the methods of clinical diagnosis as well.

A special feature of the book is the number of plates given illustrating the use of the X-rays in differential diagnosis. We must admit, however, that the reproductions are not very convincing of the reliability of this new aid to diagnosis. We believe that good X-ray plates and photographs may be of service, but great care must be exercised to prevent misinterpretation of the findings. The writer has used the X-ray in an interesting manner in demonstrating the relationship of the trachea and bronchi. The latter have been filled with small shot and then a skiagraph taken. The skiagraph shows very well the branchings of the bronchi in the middle and lower lobes, but not at all well in the upper.

Gibson and Russell's Physical Diagnosis. Third edition revised and rewritten by Francis D. Boyd, C. M. G., M. D., F. R. C. P. Ed.; Assistant Physician, Edinburgh Royal Infirmary; Physician to the Deaconess Hospital; formerly Clinical Medicine Tutor, Royal Infirmary, Edinburgh. With one hundred and forty-four illustrations. (*New York: D. Appleton & Co.; Edinburgh and London: Young J. Pentland, 1902.*)

The first edition of this admirable little work appeared in 1890. In this edition the subject-matter, comprising 448 pages, has been brought well up to date by the editor, Dr. Francis D. Boyd. The volume will be found to be extremely serviceable, not only to the medical student, but also to the practitioner who wishes to become familiar with the most recent methods of diagnosis.

The methods of physical diagnosis are clearly but concisely described. The physical examination of the thoracic and abdominal viscera and of the nervous system is dealt with at greatest length, as would be expected. The volume also takes up the

methods of examining the body fluids and excretions in health and disease. Those methods that have proved most serviceable for diagnostic purposes have been given most attention. The sections on the blood, urine, sputum, gastric juice and fæces are admirable.

We have no hesitation in affirming that this little work, considering its modest dimensions, is the best in its line that has come to the attention of the reviewer. Its great virtues are conciseness and accuracy and it is full of useful, practical information.

Practical Diagnosis: The Use of Symptoms and Physical Signs in the Diagnosis of Disease. Fifth edition revised and enlarged. By HOBART AMORY HARE, M. D., B. Sc., Professor of Therapeutics in the Jefferson Medical College of Philadelphia; Physician to the Jefferson Medical College Hospital, etc. Illustrated with 236 engravings and 25 plates. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

Four previous editions of this work have been published since its first appearance in 1896, ample evidence of its popularity with students and practitioners. In this, the fifth edition, being a large octavo volume of 698 pages, the methods of practical diagnosis have been brought up to date and the work is sure to retain its good reputation.

The subject-matter has been in large part rewritten and much new matter added. The work is essentially one on semiology and is, in the opinion of the reviewer, designed rather for the advanced student and practitioner than for the beginner. The general plan of the former editions has been followed. The symptoms used in diagnosis are discussed first, and their application to determine the character of the disease comes later. The methods of examining the blood, urine, gastric juice, etc., are given more or less fully and are useful; but as is usually the case in a work of this nature, not sufficiently in detail to obviate the necessity of the student or practitioner purchasing a book or books dealing specially with these methods of examination, if he is desirous of more than a mere smattering of knowledge in this particular line.

The value of the volume is much increased by a profusion of good figures and plates.

Diseases of the Eye: A Handbook of Ophthalmic Practice for Students and Practitioners. By G. E. DE SCHWEINITZ, A. M., M. D., Professor of Ophthalmology in the University of Pennsylvania; Consulting Ophthalmic Surgeon to the Philadelphia Polyclinic; Ophthalmic Surgeon to the Philadelphia Hospital; Ophthalmologist to the Orthopædic Hospital and Infirmary for Nervous Diseases. With 280 illustrations and 6 chromo-lithographic plates. Fourth edition, thoroughly revised. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The appearance of a fourth edition of this work at so early a period in its history is good evidence that it still finds favor. A text-book on the eye to meet the requirements nowadays should be written by one who is in teaching contact with students, and that is no doubt why the work of Edward Meyer is so popular in France and the text-book of Fuchs is so widely used throughout Germany and Austria. Both are from the hands of teachers who know what students and practitioners need, and while the work of Fuchs is more exhaustive, more of a reference book than either that of de Schweinitz or of Meyer, still one can see that its author is a teacher. In this country de Schweinitz's work occupies pretty much the same position as do the other two works just mentioned in their respective countries. In this new edition we find special paragraphs on the following subjects: Conjunctivitis Petrificans; Metastatic Gonorrhœal Conjunctivitis; Hysteric Alopecia of the Eyelids; Relapsing Bullous Keratitis; Atheromatous Ulcers of the Cornea or Scar-keratitis; Ophthalmoscopic Signs of General Arteriosclerosis; Traumatic Perforations of the Macula Lutea, the so-called Holes in the Macula; Educative Treatment of Strabismus; Ocular Signs of Diseases of the Sphenoid and Antrum; Acoin; Dionin; Suprarenal Capsule and its preparations, etc. Some of the chapters have been largely rewritten, while others have been either condensed or materially altered. Many therapeutic agents of recent date, particularly the newer silver salts, find mention in connection with the diseases in which they are indicated.

An earlier edition of this work was recently reviewed, and it is unnecessary to go over in detail this fourth edition further than to repeat what was said on a former occasion and to say that the last edition brings the work abreast with what is valuable in ophthalmology and makes it worthy of the highest commendation.

A Text-Book of Materia Medica, Therapeutics and Pharmacology. By GEORGE FRANK BUTLER, Ph. G., M. D., Professor of Materia Medica and Therapeutics in the College of Physicians and Surgeons, Chicago, Medical Department of the University of Illinois; Medical Superintendent of Alma Sanitarium, Alma, Mich., etc. Fourth edition, thoroughly revised, pp. 896. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The author has succeeded in producing a very fair text-book, which, however, does not differ in any essential way from the numerous similar ones on the market. The style is clear and the subject-matter well arranged. The final chapter on the relation of Physical Chemistry to Pharmacology is contributed by Dr. Martin H. Fischer, formerly of the University of Chicago. It is significant enough to have a short chapter under this heading appearing in our text-books of Pharmacology, but more space could very profitably be devoted to this subject.

The Practical Medicine Series of Year Books, Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Issued monthly. Under the general editorial charge of GUSTAVUS P. HEAD, M. D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Vol. III, The Eye, Ear, Nose and Throat. Edited by CASEY A. WOOD, C. M., M. D., ALBERT H. ANDREWS, M. D., T. MELVILLE HARDIE, A. M., M. D. (*Chicago: The Year Book Publishers, December, 1902.*)

We are favorably impressed with the practical character of the contents of this volume. Wood's contribution contains not only what will interest the ophthalmologist, but a great deal which will be found helpful to the general practitioner. One will find recorded the most important advances in ophthalmology during the past year and in addition many sensible comments upon the things which are of real value, based upon the experience of one who is a recognized leader in American ophthalmology. The chapters on the Cornea, Ocular Muscles, and Therapeutics are particularly good. The Ear Department, which is assigned to Andrews, brings the advances in otology up to date and consists of well-selected abstracts from recent otological literature. We miss here the numerous editorial comments which help to make the Eye Department such an effective article. The Nose and Throat Department is edited by T. Melville Hardie and will be found to contain a full account of what has been going on in these branches during the past year. We are glad to see that the editor has taken the opportunity to give many of his own views.

The volume as a whole then is full of useful information and we might only suggest that in future those who participate in its editorship will seize the opportunity to throw more of the personal element into their contributions.

Burdett's Hospitals and Charities, 1903. Being the Year Book of Philanthropy and the Hospital Annual, containing a review of the position and requirements, and chapters on the management, revenue and cost of the charities. By SIR HENRY BURDETT, K. C. B., editor of "The Hospital," etc. (*London: The Scientific Press (Limited), 28 and 29 Southampton St., Strand, W. C.; New York: Charles Scribner's Sons.*)

This unique and excellent volume is in its fourteenth year. It is hardly possible to conceive how the information contained in it could be secured elsewhere. It represents an amount of labor somewhat appalling, expended both in securing statistical information and in interpreting it after it has been gathered from all quarters of the globe. The statement is often made with a degree of truth that hospital work is not sufficiently correlated and that uniformity of procedure is lacking even in the most advanced institutions. This is doubtless partly due to the fact that hospital management has not yet attained to the dignity of a settled profession, and in America at least its excellence or otherwise depends quite too much on the merits or demerits of the man who holds the position of superintendent. Allied to this, however, is the stronger reason that no settled system of hospital administration exists in America or Europe. The duties of the superintendent, the relations of the nurses to the hospital, the system of accounts, and even methods of tabulating patients and computing recoveries or mortality, all vary in different hospitals. It accordingly follows that the operations of different hospitals cannot be compared and officials lose the stimulation to the best work which follows a rigid comparison with the results attained in other hospitals. The object of this book is to introduce and enforce uniformity in accounts and statistics to the end that the results of charity may be accurately known. An admirable summary is given of the present condition of English hospitals and much encouragement can be derived from the great relief to the finances of the London hospitals by the King Edward Fund. If a similar movement could be initiated here it would relieve great anxieties on the part of hospital managers. The advantage of close co-operation between hospitals is also admirably shown by the results in London. A strong plea is made for the absolute financial separation of the charity hospital and the medical school. The author's statement that "it is essential that every voluntary hospital where medical education is provided shall so adjust the relations between these two bodies as to secure that not one penny of the money given by the public to the relief of the sick poor shall be devoted to the purposes of medical education," commends itself to all.

He also regards it as desirable that every large hospital should have a medical superintendent. He says: "In a clinical hospital where the *personnel* of the resident medical staff constantly changes, where there is necessarily a large number of medical students and an equally large and increasing number of probationer nurses, there must be an ever-growing tendency to carelessness in the use of materials, such as bandages, lint and a host of other things, which will tend to increase rather than to diminish, unless every detail is constantly supervised with watchful care by an officer of responsibility, of wide discretion and sufficient influence. We believe from a close comparison of the expenditure of a large provincial hospital where there are no medical students, with several of the large London clinical hospitals where the cost per bed has steadily gone up year by year for a number of years past, that there is a growing tendency in the direction of wasteful expenditure due to the absence of adequate control within the walls of certain clinical hospitals. The matron may be the ablest of her class; she may possess the widest experience and be untiring in her zeal to secure the best results and efficiency, but whatever she may do, it is not her province, nor ought she to attempt to exercise authority outside her department, for efficiency in administration can alone be maintained by having a system which includes a medical superintendent, resident medical officers, a matron and all other minor officials, each entrusted with definite duties confined to their individual departments and working together for the good of the whole institution under the immediate personal direction of a medical superintendent of the highest attainments, whose controlling hand is essential, if the maximum of success is ever to be secured."

A chapter of the book is devoted to a discussion of the question of Home and Foreign Missions. Statistics are given to show that, as might naturally be expected, the percentage of administration expenses to contributions received is very large in the smaller missionary societies, and that as business enterprises they are open to criticism. The tone of the book is in no sense hostile to missions and the facts and figures merely are presented. The sensible suggestion is made that in the field of foreign missions a greater degree of co-operation be sought, so that the world may be divided up in a systematic manner among the various mission boards to the end that duplication of effort and unwholesome rivalry may cease.

There are excellent chapters on nursing in London, on the hospitals of the United States, on the cost of out-patient departments of hospitals, and other equally interesting topics. The book deserves to be in the hands of every philanthropist and charity worker.

The Latin Grammar of Pharmacy and Medicine. By D. H. ROBINSON, Ph. D. With an introduction by L. E. SAYRE, Ph. M., Professor of Pharmacy, etc., University of Kansas. Fourth edition, with elaborate vocabularies, thoroughly revised by HANNAH OLIVER, A. M., Assistant Professor of Latin, School of Pharmacy, University of Kansas. (*Philadelphia: P. Blakiston's Son & Co., 1903.*)

We had occasion to commend a first edition of this book several years ago. The present work is substantially a new book, being modified in many important particulars to fit it better for the use of students of medicine and of pharmacy. It is interesting to observe that the authors believe that the best manner to teach the student of medicine to read and write prescriptions in Latin is to teach him the language. In some treatises on prescription writing and pharmacy we have observed a tendency simply to teach the bare words to be used without reference to teaching anything more of Latin. The method adopted in this work seems much more in accordance with the spirit of a proper education. It surely is better that the student should learn to use medical Latin rather than that he should learn a few essential words by rote, parrot-fashion, without any conception of the laws and usages of the language. The vocabularies are very good and the index is satisfactory

Lessons and Laboratory Exercises in Bacteriology: An Outline of Technical Methods Introductory to the Systematic Study and Identification of Bacteria. By ALLEN J. SMITH, M. D., Professor of Pathology in the University of Texas, Galveston. Price $1.50. (*Philadelphia: P. Blakiston's Son & Co. 1902.*)

This manual resembles Frost's Laboratory Guide, but lacks many of the excellent features of that introduction to bacteriology, especially the simple arrangement and the close relation of the exercises to the systematic study of bacterial species. The book is superior in typography and general appearance. Bacteriological technique is fully presented, much matter being included for which the student usually seeks in text-books or reference-books. It is gratifying to note that classification is dealt with from a scientific standpoint and that use is made of the new nomenclature. It is to be regretted that the commonly used equivalents are not presented with the preferred names. Although

Bacillus pyocyaneus may be recognized under the name Pseudomanos pyocyanea, one is left in doubt as to the identity of Bacterium pneumonicum and Bacterium pneumoniæ. The list of equivalents given on page 272 is of historical interest, but of little value for the differentiation of the terms now in use.

The excellent feature of the book is its completeness. From the mass of material presented the teacher may select the exercises best suited for class use and supply the lack of close relation to the study of individual species for which the only provision is the supply of blank sheets for the description of culture features, etc.

The appearance of so large a number of these manuals and laboratory guides to bacteriology makes one question whether there is a real need for so many, and suggests that some official publication, i. e., by the Bacteriological Committee, might better meet the needs of teachers and students.

Eye Symptoms as Aids in Diagnosis. By EDWARD MAGENNIS, M. D., D. P. H., late Clinical Assistant at the Royal London Ophthalmic Hospital, etc. (*Bristol: John Wright & Co.; London: Simpkin, Marshall, Hamilton, Kent & Co., Limited, 1903.*)

This is a convenient little manual which may be commended to physicians in general practice who desire to refresh their knowledge of matters essential to the diagnosis of diseases other than those of the eye. The summary of the relations of the pupils to organic brain disease is admirable and very serviceable. The same may be said of the portion of the book which treats of the fundus of the eye and of the ocular muscles. A glossary of ophthalmic terms is appended, also a full index. The book is a valuable aid to the busy physician.

Obstetrics. A text-book for the use of students and practitioners. By J. WHITRIDGE WILLIAMS, M. D., Professor of Obstetrics, Johns Hopkins University; Obstetrician-in-Chief to the Johns Hopkins Hospital, etc. With eight colored plates and six hundred and thirty illustrations in the text. (*New York and London: D. Appleton & Co., 1903.*)

The contributions to medical literature by Professor Williams have been of such importance, and his reputation as a teacher is so well known, that the appearance of this volume has been awaited with unusual interest and has attracted much deserved attention.

The work, which is dedicated to Professors Welch and Councilman, is a well printed and well illustrated volume of some 850 pages. The text reads unusually easily, for it is modestly written in a very clear style. As if forecasted by the dedication, the histology and pathology of the subject are treated in a most lucid and comprehensive manner, one that admits of but little comparison with other kindred English text-books. The author states in the preface that he hopes the volume may serve as a laboratory guide for the student, and we surely know of no other that may fill such a place in so acceptable a manner. More than that, it forms the nucleus of a most excellent bibliography. The scheme adopted has been to refer to the various articles which mark the history and the recent advances of each subject. These references have been verified in each instance. Where the bibliography of the subject is unusually large, especial mention has been made of those articles which are particularly rich in the literature of the subject. The bibliography is arranged at the end of each chapter.

The admirable treatment of the subject-matter is well shown by the opening chapter upon the pelvis. It is considered from the historical, obstetrical, sexual, racial and developmental points of view. The clinic of the Johns Hopkins Hospital obstetrical service is especially rich in contracted pelves, and in considering the racial differences in the pelvis, the author calls attention to the very interesting fact that contracted pelves occur several times more frequently in blacks than in whites (21 per cent and 7 per cent), while the frequency of operative deliveries is greater among the latter. This would appear to be due to the smaller size of the head of the colored fœtus, and its greater compressibility, which the author believes may be attributed to the poorer nourishment of the colored race in the large cities.

The chapters dealing with the anatomy and embryology are of unusual merit. No attempt has been made to trace the development of the ovum through all its stages, but the changes which are directly concerned in the formation of the fœtal membranes and the placenta are fully described. It is refreshing to see that the embryology is taught from the standpoint of human development. In considering the formation of the human amnion, the author advocates the view of Spee, that the process begins as an inversion of the original blastodermic wall, and when we bear in mind the complicated diagrams that have been adduced from time to time to explain this process, we rejoice that there is confirmatory proof by Selenka in the anthropoid apes, and sincerely hope that so simple and clear a theory may never be disproven. The chapter on the formation of the early placenta is, we believe, the best that has appeared in an English text-book. Very little importance is attached to the part played by the so-called decidual septa in this process. Contrary to the former theories, the author holds that this tissue is fœtal in origin and is developed from trophoblasts which were not utilized in the formation of chorionic villi.

The mechanism of labor is presented in a very clear and painstaking manner, and is illustrated by many new drawings and diagrams. Especial stress is laid upon the importance of abdominal examination, and it is shown that the head at the level of the ischial spines may be palpated by invaginating the perineum. This should limit the field of vaginal examinations to ascertain the condition of the cervix and membranes, and the compressibility of the fœtal head. In the preparation of the hands thorough scrubbing is advised, followed by disinfection by solutions of permanganate of potash, oxalic acid and bichloride of mercury. We are in accord with the suggestion of shaving the patient in operative deliveries, and would go so far as to insist that it be followed by cleansing of the perineum with the solutions advocated for the hands. In view of the acknowledged fact that the external genitals contain pathogenic bacteria, we believe the man is grossly culpable who cleanses his hands by the most approved of methods but fails to devote the same care to the preparation of the perineum. It appears furthermore, that advances in obstetrical technique must be made from the standpoint of the preparation of the patient. Inasmuch as the normal pregnant vagina is not the habitat of pyogenic bacteria, Dr. Williams believes that the routine use of prophylactic douches is more apt to be productive of harm than good. Chloroform is preferred to ether, and its use is commended in all cases during the second stage unless there is especial contra-indication. The author does not favor the use of cocaine in obstetrics and seems to believe in the efficacy of ergot, which of course he would never use until the completion of the third stage. We are somewhat surprised that Dr. Williams has seen no cases upon which he would perform episiotomy. In our experience this is an operation of great value. If properly employed it may prevent, in forceps cases, such lacerations of the vagina as will lead to subsequent relaxation.

The chapter on obstetrical operations is considered immediately after the mechanism of labor. This we believe is its logical position. The application of forceps is recommended as taught by Farabeuf and Varnier, that the first blade be applied to the posterior ear, and its fellow rotated into place, thus giving a grasp in the jugulo-parietal diameters of the head. In high

forceps, however, if the sagittal suture lie transversely, the method as advocated by Budin is endorsed, and the application is made obliquely, thus preventing the possibility that the posterior blade bridge over the anterior concavity of the sacrum and add to the relative contraction of the pelvis. For unreduced occipital posterior presentations, the Scanzoni application is highly commended.

The induction of premature labor in the treatment of contracted pelves finds little support in this work. The author reports 278 cases of contracted pelves in which pregnancy was allowed to come to term, with a fœtal mortality of but 13 per cent, and when we remember that the induction of premature labor carries with it a fœtal mortality of 12 to 45 per cent, the reason for this plan of treatment is apparent. He favors the extension of the relative indication for Cæsarean section to pelves with a conjugata vera of 7.5 to 8.9 cm. and would operate on all cases at term and in good surroundings and condition, if hard second-stage pains for some hours had shown that there was no likelihood of engagement of the head. If, however, the patient and the fœtus were not in good condition and surroundings, he believes it is more conservative to try forceps tentatively, and if no advance occurs, to deliver after craniotomy. This teaching will tend to increase the number of Caesarean sections in hospital practice, a plan of treatment which the author thinks will lessen the fœtal mortality, and keep that of the mother at a minimum. Symphysiotomy is not regarded with favor, and it is stated that this operation is more difficult to perform than Caesarean section and has no advantages over it, consequently it is not suitable for the general practitioner to perform.

Where there are so many chapters of unusual excellence, it must suffice, in passing, merely to call attention to the value of the discussion of Fœtal Syphilis, Deciduoma Malignum and Extra Uterine Pregnancy. The discussion of contracted pelves forms the most complete monograph probably in the English language. The importance of the subject is shown by statistics from the clinic of the Obstetrical Department of the Johns Hopkins Hospital. Every 14th white woman and every 5th colored female had an abnormal pelvis. The classification in the main is that of Tarnier and Budin, and the article is profusely illustrated by many excellent drawings, and diagrams are presented all constructed to a scale, and said to be accurate within 1 mm.

Other chapters which must be regarded as monographs are those upon Eclampsia and Puerperal Infection. All the important theories as to the etiology of the former disease are reviewed, save, perhaps, the very recent one as to the relation of the thyroid secretion and the oxidation of the nitrogenous excreta. In the matter of treatment, it is taught that the uterus should be emptied whenever it can be done in a conservative manner. Prof. Williams seems inclined to bleed all cases which do not show signs of rapid improvement shortly after delivery, even those in which the pulse is thin and weak. This does not entirely commend itself to us, for we believe that the condition of the pulse may contraindicate bleeding. Moreover, it would appear that in certain cases, as in beginning pulmonary œdema, the transfusion following bleeding may be productive of harm. Perhaps mention should have been made of the operation of decorticating the kidney, in the desperate cases of anuria. The author condemns the use of pilocarpine, and states that he has had no personal experience with veratrum viride.

The treatment of puerperal infection is taught as deduced from the study of the bacteriological findings. Thus, he would never use the curette in streptococcus infections, for the reason that the organism has in all likelihood penetrated to the depths of the uterine wall by the time the disease is recognized. If the uterine cavity is not clean, it should be emptied with the finger. The statistics of his clinic show that the streptococcus combined with the colon bacillus has been the most fatal. The douche should only be employed in infections with putrefactive organisms and then saline solution should be used. Statistics are quoted to show that fatal results may follow the use of antiseptic solutions as a intra-uterine douche. The administration of the anti-streptococci serum is not regarded as of much value, nor does the author think that hysterectomy and excision of the pelvic thrombi is an operation likely to lead to the best results.

In general we believe that the book is the best which has yet appeared in English. It has the advantage of being thoroughly scientific and at the same time practical, and in our judgment it is destined to live. There are several errors in proof-reading which we look to see corrected in the next edition, at which time we hope the volume will be better bound. Unusual care has evidently been devoted to the illustrations. They are for the most part original, and while not all objects of art, admirably serve to illustrate a point. The microscopic reproductions are unusually fine.

The author may well be proud of this excellent volume.

The American Year Book of Medicine and Surgery. Being a Yearly Digest of Scientific Progress and Authoritative Opinion in all branches of Medicine and Surgery, etc. Under the general editorial charge of GEORGE M. GOULD, M. D. Surgery. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

Out of the mass of medical literature, produced in part, it would seem, somewhat from the motive of the man who kept the Directory on his parlor table because it contained his name in print, here is one which will receive a unique welcome from the busy practitioner, the specialist and the student of scientific medicine. A good yearly digest will, if it fall upon busy days, find a demand; and the American Year Book of Surgery is a good yearly digest. It certainly will not suffer by comparison with similar works in other tongues and one cannot but be struck by the consistent excellence of its six hundred odd pages of reviews. Everywhere the essential has received due attention and the unessential has been omitted altogether, with the resultant thoroughness and compactness of a good review. Some degree of discrimination is obvious, too, in the selection of articles for notice; though, in a branch of science so written to the death as medicine the reviewer must of necessity deal with much that is hackneyed if he is to make a book of any dimensions at all. One might suppose, for example that the interest attached to the question of the leukocyte count in appendicitis had been largely destroyed by the continued harangues of those, on one side, who hold that it is of supreme operative value and of those, on the other, who hold that it has no operative value whatever; yet, with important appendiceal problems, like the technic of placing gauze drainage, still receiving scanty attention, this question of the leukocyte count and its brother problem (the "when-shall-we-operate" question) continue to dominate the journalistic field. Text-book articles with nothing of novelty in them, either of content or of style, continue to be written and re-written with the report of a case as an excuse; and, appearing in prominent journals over a prominent name, they must of course be dealt with in a yearly report. Vandeveer and Elting's résumé of actinomycosis and Abbé's "Surgical Complications of Typhoid Fever"—both of them treated at some length in the book before us—are cases in point. The former is little more than a reprint of Rührah's article which was itself only a compilation from the text-books; and for the latter there could be no possible excuse after Keen's classical publication. Here and there Dr. Gould has allowed surgical platitudes to add mass to and subtract quality from an otherwise discriminating review. It is disappointing, for example, to read in the early pages of the book that "boiling renders gloves perfectly sterile;" and, a little later, that "the knife offers the only absolute cure for cancer." We had supposed

the medical school to be the place for teaching the elements of asepsis and for ringing the knell of the arsenic paste treatment of cancer, and we question the wisdom of the usurpation of this function by the leading American surgical year book. If the object of a yearly digest be to disseminate elementary knowledge there can be no doubt about the advisability of giving up nearly two pages of the American Year Book to Senn's perfectly orthodox truisms about cancer; but we doubt very much if a yearly digest should try to do the work of a tract. When this general criticism is made, however, the worst is said; and it is after all an adverse judgment not so much on the discrimination of the reviewers as on the untimeliness of medical literature which gives discrimination little or no chance to function if reviewing is to be done at all. Dr. Gould has given us splendid briefs; that he has had poor cases to deal with is, after all, no fault of his. Of the general condition of surgery for the past year, as reflected in its literature, the American Year Book furnishes an account that is sprightly, thorough and compact.

It would be hoisting Dr. Gould with his own petard to call attention to his spelling; but we cannot fail to notice the somewhat pretentious "appendicectomy" and "diagnosticate," and the pedantic "hypodermatically" which does valiant service here and there but is often replaced by the unassuming "hypodermically"—whether from a shift in the reviewer's orthographical principles or from sheer exhaustion on the part of the typesetter does not appear. J. C.

The Practical Medicine Series of Year Books. Comprising ten volumes of the year's progress in Medicine and Surgery, issued monthly, under the general editorial charge of GUSTAVUS P. HEAD, M. D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Volume I. General Medicine. Edited by FRANK BILLINGS, M. S. M. D., Head of the Medical Department and Dean of the Faculty of Rush Medical College, Chicago, and J. H. SALISBURY, M. D., Professor of Medicine, Chicago Clinical School. October, 1902. Cloth, 8vo, 5×7, pp. 358. (*Chicago: The Year Book Publishers.*)

The little volume before us is the first of the second series of Year Books to be issued under the supervision of Dr. Head. Confined as it is to the subjects of General Medicine, it brings together in short, concise paragraphs the latest facts and theories from writers the world over relating to those large systemic diseases which are now grouped together as belonging to the broad specialty of General Medicine. Here then are to be found treated Diseases of the Respiratory Organs, which include pulmonary tuberculosis, pneumonia, bronchitis, pleurisy, etc.; diseases of the circulatory organs, diseases of the blood and the blood-making organs, general infectious diseases, metabolic diseases embracing gout, diabetes, myxedema; diseases of the ductless glands, diseases of the kidneys, and finally a group of miscellaneous diseases such as osteomalacia, osteitis deformans, caisson disease, etc.

Under the careful scrutiny of Drs. Billings and Salisbury little that was old or trite has been allowed to creep in, so that the book really embodies scarcely anything which has not been put forward as new in the year preceding publication.

To admit for a moment, however, that all that is new is therefore of value would be an admission far from the truth, or from the purpose of the editors, their plan being rather to gather together the most likely theories and the newest facts. To this book then one may profitably turn to learn how during the year the medical mind of the world was looking upon many important problems. Tuberculosis is first taken up and the various ideas and proofs of the relation of bovine to human tuberculosis are considered in a half dozen pages, Adami's conclusions upon the subject being set out in full. This first example illustrates the manner of treatment of the various topics throughout.

It is a pleasure to note that under the heading of therapeutic measures much conservatism has been displayed, only such remedies and modes of treatment being inserted as for the most part would appeal to the thoroughly rational physician. The book is neatly gotten up, is small and light, and one can in a very short time run over all that is here said to be new in the past year upon any given subject, and from the wide range of journals and authors cited it is fair to presume that little of value has escaped these two careful and conscientious editors.

H. B. J.

Tuberculosis: Recast from Lectures delivered at Rush Medical College, in affiliation wtih the University of Chicago. By NORMAN BRIDGE, A. M., M. D., Emeritus Professor of Medicine in Rush Medical College; Member of the Association of American Physicians. Handsome 12mo volume of 302 pages, illustrated. Cloth, $1.50 net. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

As told in the preface, this little book represents the substance of the lectures on Medical Tuberculosis delivered by the author in the Rush Medical College during the past three years, particular stress being laid upon measures for the protection of the community from the spread of the disease.

The old inadequate way of regarding consumptives and dealing with their diseases was due, in the author's judgment, partly to habit, partly to the gloom with which such invalidism was surrounded. But in this day of better hope for the victims of this appalling disease and a better knowledge of how to prevent it, a new science and a new gospel need to be taught that the profession and the public may be aroused to their duty; and this book is submitted in the hope that it may help, if only in a small way, toward this consummation.

Such purposes are surely commendable and timely, and whatever is written with these motives must contribute to a greater or less extent in carrying forward the great work which now lies before each community, municipality and state.

The book is divided into eighteen short chapters, each embracing some one special feature of the subject. For instance, Chapter I deals with "The Bacillus Tuberculosis," and considers the organism in its various aspects, its history, its morphology, its staining qualities, its chemistry, its growth, its pathogenicity in man and different animals, its fluid products from artificial growth, the tuberculin of Koch.

Succeeding chapters are devoted to The Tuberculous Process, Forms of Tuberculosis, Pathology, Symptoms, Physical Signs, Diagnosis, Prognosis, then an important chapter on Prophylaxis, followed by several upon Treatment, Hygienic, Climatic, Medicinal, and finally a chapter upon the advantages of Sanatorial Treatment over any form of home treatment.

The book is simply, clearly and pleasantly written, full of instruction wholly scientific in character, without attempting to be an exhaustive or an exhausting monograph upon its subject—a book full of good sense which no one will read without profit.

H. B. J.

A Manual of Practical Hygiene. By CHARLES HARRINGTON, M. D., Assistant Professor of Hygiene in the Medical School of Harvard University. Second edition, revised and enlarged. Octavo, 760 pages, illustrated. (*Philadelphia and New York: Lea Brothers & Co., 1902.*)

A great mass of information is presented, of high value for reference. Food, air, soil, water, habitations, sewage, garbage, and disinfectants are treated very fully and very well. Chapters of much interest are devoted to military, naval and marine

hygiene, impressing the reader with the importance of the sanitary lessons to be learned from the various methods followed in the care of large bodies of men under conditions more readily controllable than in civil life. Tropical hygiene, the hygiene of occupations, personal hygiene, the relation of insects to human diseases, preventive inoculations, vital statistics, quarantine and the disposal of the dead finish the list. Physical and chemical methods of analysis abound, although bacteriological methods are but lightly dealt with. Many tables of analytical results from the examination of foods are given, as well as tables of physical data on all sorts of useful subjects, and authorities are freely quoted. No chapter heading, other than that on insects contains the word "disease," and the communicable diseases are treated throughout the book only incidentally. The student, the physician and the health officer, for whom the book was written, will find it very complete in much that they may often wish to know and have little time or opportunity to look up elsewhere. But the main work of the physician and especially of the health officer in practical hygiene as it exists to-day is the suppression of the infectious diseases and the information given on this subject occurs scattered in widely separated paragraphs. Regular public health methods, such as notification, isolation, etc., are discussed only in the most general way, while the pathology, diagnosis and treatment of bad plumbing receive the traditional amplitude of description, notwithstanding the beliefs expressed on the fallacy of attributing any great hygienic importance to the acquired lesions or congenital defects of soil or service pipe.

The section on water contains an excellent discussion of the interpretation of chemical water analyses, and of the relative values of this and of the bacteriological method. We cannot but wish that the interpretation of both forms of analysis as employed to determine the purity of ice had been added, since many misapprehensions exist concerning their usefulness in this field. In the transmission of water samples to a distance for bacteriological analysis ice-packing is advised, as indeed it must be, but in view of the work of Whipple, Jordan and others, it is hardly proper to say that the low temperatures thus secured "have no harmful effect on the vitality" of the bacteria, especially when the diminution of typhoid bacilli in ice demonstrated by Sedgwick and Winslow, Park, etc., is quoted in a preceding section.

The appearance, color, etc., of normal and other waters receive a paragraph, in the section on water, but the appearance of normal milk, in the milk section, is dismissed without description, in spite of the exhaustivenss of this section in other respects. Not everyone knows, by observation or intuition, why milk is white. Tyrotoxicon is quoted (p. 88) on Dr. Vaughan's authority as the exciting cause of milk and cheese poisoning. In view of the scepticism of Vaughan's conclusions on this subject sometimes encountered, we wish that further evidence could have been adduced, and it is worth noting that the recent (1903) edition of Vaughan and Novy states that tyrotoxicon, in cheese poisoning at least, is probably of rare occurrence.

The sterilization of milk is said (p. 92) to require "continuous heating under pressure for about two hours at 248 F." Laboratory experience indicates that the time given is excessive, fifteen minutes at the temperature mentioned being quite sufficient for tubed milk; milk in bulk requiring only so much additional time as shall insure every part of the liquid reaching the desired temperature.

Frankland's hypothesis that normal water is toxic to bacteria, set forth to explain the greater development of bacteria in boiled than in untreated water (p. 334), should, we think, be accompanied by the alternative and equally logical hypothesis, that boiling merely modifies favorably the otherwise "raw," and so less assimilable materials which serve as bacterial food.

Amongst minor irregularities inseparable from so large a book are the obsolete use of micrococcus for bacillus in the specific name of *B. prodigiosus* (p. 295), and the statement (p. 304) that *anthrax* spores were sought for in attempts to trace the source of tetanus infection from blank-cartridge and other fireworks wounds.

The triviality of some of the above criticisms is itself evidence for the general accuracy of the book. Perhaps the most interesting general topic suggested by its perusal is the question of the limitations of practical hygiene. Taking the author's work as a basis for the inductive determination of the question, we should be forced to believe that hygiene, practical or otherwise, includes the physics, chemistry and biology of the immediate environment of man. This is surely a wide field, and few can ever hope to know personally and in detail more than a very small portion of it. Hygienists should feel grateful to Dr. Harrington for accumulating and presenting, clearly and carefully, so much of the best available information on these subjects.

HIBBERT WINSLOW HILL.

Hygiene and Public Health. By LOUIS PARKES, M. D., D. P. H., and HENRY KENWOOD, M. B., D. P. H., F. G. S., the former late, and the latter present, Assistant Professor of Public Health at University College, London. Second edition, 763 pages, illustrated. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

This is a recast of a book of identical title by the first mentioned of the joint authors. It aims to give, in a condensed form, the essentials of hygiene and public health administration, for the use, particularly, of those preparing for the diploma of public health.

The second edition was called for within a year of the issue of the first, and has been favorably reviewed in England. We should be sorry nevertheless to think that this book correctly represents the best English teaching of the day in hygiene. The section on the Contagia and Communicable Diseases is very good, vaccination in particular receiving excellent treatment. The section describing the hygiene of habitations, and those on personal hygiene present little to criticise. Preservatives in milk are discussed with judgment and the logical basis of the investigation of epidemics in practice is well set forth. Disinfection is considered rather conventionally, except for the statement that a pint of phenol can be vaporized by placing in it "a small rod" made red hot! Such a phenomenon could of course only come to pass "under a suspension of the rules" relating to latent heat and the conservation of energy.

Serious defects are to be found in the section on Water. This begins, in the traditional way, with the Roman aqueducts, discusses diffusely the general subject of water supply, and ends with the interpretation of chemical water analyses for sanitary purposes. Much which is given is valuable, but all is vitiated by the false principles on which the author's teaching is based. These principles become evident in the remarkable statement (page 77) that "Organic matters" (in water) "derived from an animal source are dangerous as well as disgusting." It would be difficult to construct a more concise denial of all the canons of modern water hygiene than this.

Under Refuse Disposal, the same false principles are shown in the reference (p. 100) to ". . . the risk of spreading disease by the fermentation of the liquid filth" (of middens, closets, &c.). Follicular tonsillitis and "diphtheritic throats" are listed (p. 156), with other troubles, as induced, directly or indirectly, by sewer and drain gases.

Evidently the authors have not escaped from the thralldom of the filth theory of disease. That they feel some reserve toward the "germ theory" is made plain by their undecided dalliance with the latter, most evident in the opening pages of the section of Contagia, the body of which, written by another hand, shows firm construction and some familiarity with the later developments of bacteriology. The bacteriological lore of the earlier

chapters is well illustrated by the following: "The microbes in sewer air are chiefly moulds, whilst those in sewage belong to the class of bacilli" (p. 223). *Bacterium termo* is described (p. 438) as a definite species, prominent in putrefactive changes.

Of minor defects there are not a few. Lack of coordination is evinced in the occurrence of two mutually exclusive statements on a rather important subject, thus; the health of towns (p. 80) is said to depend largely on the efficient removal of refuse; later on (p. 259) the health of towns is said to depend largely on sunlight and fresh air.

Much attention is given to the details of plumbing work, no longer considered by the best thinkers in sanitary matters as of any great hygienic importance. This following of a time-honored custom may perhaps be the more readily pardoned in view of the large number of fellows-in-error who might be quoted by the defence.

While we cannot feel justified in judging, at this distance, of the value of this book to prospective health officers in England, we believe that, of American students, only those who wish to review some of the transitional vagaries through which the principles of modern hygiene have now more or less successfully threaded their way will profit by its perusal.

HIBBERT WINSLOW HILL.

A System of Physiologic Therapeutics, Vol. V. Edited by SOLOMON SOLIS COHEN, A. M., M. D., Senior Assistant Professor of Clinical Medicine in Jefferson Medical College. In three parts.

Part I.—Prophylaxis. By JOSEPH MCFARLAND, M. D., Professor of Pathology and Bacteriology in the Medico-Chirurgical College, Philadelphia, and W. WAYNE BABCOCK, M. D., Lecturer on the same subject in the same College. 319 pages.

Part II.—Civic Hygiene. By HENRY LEFFMAN, M. D., Professor of Chemistry and Toxicology in the Women's Medical College of Pennsylvania. 43 pages.

Part III.—Domestic and Personal Hygiene; Nursing and Care of the Sick-Room. By ALBERT ABRAMS, A. M., M. D. (Heidelberg), Consulting Physician to the Mount Zion Hospital and the French Hospital, San Francisco. 145 pages. First edition, octavo, illustrated. (*Philadelphia: P. Blakiston's Son & Co., 1903.*)

The editor describes this book as an Introduction to the Science of Medicine. The name fits. Freshmen may read it—with a dictionary—much to their subsequent profit. The fourth year man may use it to concentrate and arrange in due perspective his accumulated facts. The "busy practitioner" will find in it a concise epitome of modern etiology, bringing him well up to date in subjects likely to be neglected in the pursuit of therapeutics. The hygienist, weary alike of platitudes and laboratory technicalities, will rejoice and take courage to see a rational, connected, terse account of the real meat of his own work.

These comments apply to each of the three parts. The style of all is very similar. No words are wasted in setting forth the teaching of the writers. Not as the scribes and pharisees, but with masterful dogmatism, they teach the best canons of the day, usually without attempt at references. To enjoy the book, one must have confidence in the writers themselves, but this is true of all writings, and no amount of quotation from authorities can make up for its absence.

The section on disinfectants (Part I) is particularly good, its introductory pages furnishing the best and most logical exposition of the outlines of the subject known to the reviewer.

Nuisances (Part II) are treated with quite unusual simplicity and good sense, leaving one a regret only for the extreme brevity of the section.

Personal hygiene (Part III) presents well-balanced, and thoroughly sane directions for the care of the body.

Beyond these sections, it is difficult to select passages notably excellent, because the average is so high throughout.

The book is one of general principles. Methods are dealt with therefore superficially or not at all. Sometimes an illustration is made to do duty alone. This is unsatisfactory to the inquiring mind. An illustration always needs some text.

Pet beliefs are so constantly upset in these days that the reader cannot but wish the statement (p. 21) "hydrophobia is *said to be* prevented" (reviewer's italics) by the Pasteur treatment, had been elaborated, since as it stands it suggests uncertainty both *pro* and *con*, as does a similar statement later on.

Under snake venoms (p. 117) attention is not clearly drawn to the distinction between local and general effects in considering the treatment of snake-bites with anti-venene, which latter is spoken of as a "perfect antidote" (p. 119). Anti-venene, we believe, is antidotal to that constituent of snake venom which acts upon the central nervous system but not to that which acts on the tissues at the site of the bite.

In discussing the modes of transmission of diseases (p. 130), there are cited as conveyers of disease first, the well but infected animal; second, the sick animal transmitting a disease similar to its own; third, the sick animal transmitting a disease differing from its own because the parasite transmitted undergoes a different phase of development in the new host (tapeworm and cysticercus, for instance). The writer is evidently treating "disease" here as a clinico-anatomical entity. Should not then a fourth class be added, to cover such cases as the derivation of gonorrheal ophthalmia from gonorrheal urethritis, where the parasite is the same in both hosts, the diseases quite different? Such cases do not fall properly under any one of the three heads given.

The illustrations, sometimes excellent, as those of the malarial parasites, do not as a rule come up to the standard of the text. This is especially true of the bacterial plates, those of *B. diphtheriæ*, *B. tuberculosis* and *B. pestis* being really atrocious. In sympathy with the famous Athenian who was tired of hearing Aristides called "The Just," we welcome the reproduction of other than Dr. Howard's excellent mosquito plates, although those of Dr. George Beyer are somewhat less clean-cut.

The typography is clear and good, but the selection of fonts does not "preserve the unities" very successfully, and the putting of catchwords in heavy-faced type, while convenient and impressive, spoils the look of the pages. The margins are rather scrimpy. So good a text deserves a better setting.

A second edition will doubtless show expansion on the subjects of immunity, paratyphoid fever, summer diarrhea, the etiology of small-pox and the disposal of sewage. We even live in hope that American data on the disposal of garbage may some day be accumulated in quantity and quality worth the quoting. Chiefly an economic problem, garbage disposal is also hygienic in the broadest use of the latter term, yet only one attempt, we believe, has as yet been made in this country to do careful comparative experimental work on its many problems.

It is superfluous to add that we consider this one of the best American books on its subject, admirably adapted to the needs of the times, and thoroughly up to date.

HIBBERT WINSLOW HILL.

Practical Points in Nursing. For Nurses in Private Practice. With an Appendix containing Rules for Feeding the Sick; Recipes for Invalid Food and Beverages; Weights and Measures; Dose List; and a full Glossary of Medical Terms and Nursing Treatment. By EMILY A. M. STONEY, late Superintendent of the Training School for Nurses, Carney Hospital, South Boston, Mass. Third edition, thoroughly revised. Handsome 12mo of 458 pages, fully illustrated, including 8

colored and half-tone plates. Cloth, $1.75 net. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

This book is well named, in that it gives the practical information which a nurse ought to possess when she leaves a hospital and enters a family to begin her career. A notice was given in the BULLETIN of an earlier edition. The present edition, owing to the lamented death of the author, has been revised and augmented by a physician who has added such material as seemed desirable to bring the book fully up to the present state of knowledge. The directions which are given for packs, baths, fumigations and various surgical procedures are clear and in many instances they are supplemented by excellent illustrations. The section on germicides and disinfection is also very complete.

We must take exception to the suggestion that a nurse can decide whether a baby is *tongued-tied* and is competent to operate upon the child.

The volume is attractively printed and helpfully illustrated and deserves a wide sale.

Medical Jurisprudence, Insanity, and Toxicology. By HENRY C. CHAPMAN, M. D., Professor of Institutes of Medicine and Medical Jurisprudence in the Jefferson Medical College, Philadelphia. Third edition, thoroughly revised, greatly enlarged, and entirely reset. Handsome 12mo volume of 329 pages, fully illustrated, including four colored plates. Cloth, $1.75 net. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

This work is based on the author's practical experience as Coroner's Physician of the city of Philadelphia for a period of six years. It is concise and specific in statement and is a manual rather than a storehouse of facts and cases. The work is divided into three parts of rather unequal merit. That on Medical Jurisprudence is undoubtedly the most valuable, as might be expected from the author's special training as coroner's physician. The section on Insanity has little merit and might as well be omitted from future editions. The section on Toxicology, although too much abridged, is much more useful. The book has a certain merit in the fact that it gives a brief outline of the important subjects treated and can be commended as a guide to those who are indisposed to search further.

Medical Microscopy: Designed for students in laboratory work and for practitioners. By T. E. OERTEL, Professor of Histology, Pathology, Bacteriology and Clinical Microscopy, Medical Department, University of Georgia. (*Philadelphia: P. Blakiston's Son & Co.*)

In looking through this book one is quite at a loss to know what its exact purpose was meant to be. Its title is most emphatically a misnomer; medical microscopy forms the minor part of its actual subject-matter. It is devoted rather to a brief outline of bacteriological methods and cultural characteristics of bacteria, and to the preparation and examination of pathological tissues, to which is appended a scanty, insufficient and inaccurate consideration of the microscopy of the blood, urine, sputum, fæces, etc. Of the 350 pages of the book, the first 230 are given up to the bacteriological and pathological portion; the following 120 pages contain the more directly clinical subjects—blood, urine, sputum, fæces. With the latter group of subjects has been fused a mass of clinical data and descriptions of macroscopic appearances, which makes the presentation far from clear, and frequently confused. The subject of sputum and fæces, the importance of which is being more and more appreciated, has been plainly neglected and receives the scantiest possible consideration. The descriptions of apparatus and of technique are, in the main, good. The illustrations have been well reproduced. It is difficult to see, however, why reproductions of apparatus should uniformly, or almost so, contain in a conspicuous position the name of the manufacturer. One is led to make conjectures as to their possible value.

The subdivision of subjects by headings and sub-headings has been done with unusual carelessness, and made unusually misleading. Unimportant headings are printed in prominent type, and some important and quite distinct subjects have been classed under headings to which they obviously do not belong. Thus, hydatid cysts and ovarian cysts are apparently paragraphed under the subject of fæces, and follow immediately the paragraph on Amœba coli. Infusoria are considered with "Vermes in the Urine."

W. B.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By PROF. DR. CARL VON NOORDEN, Senior Physician to the City Hospital in Frankfurt a. M. Part I. Obesity: Indications for Reduction Cures. Authorized American edition. Translated under the direction of BOARDMAN REED, M. D., by DR. ALFRED C. CROFTAN. (*New York: E. B. Treat & Co., 1903.*)

The introduction is devoted to a plea for rational therapeutics. "Each case presents is own needs," and "the physician who invariably prescribes the diet given by Dr. X. or treats his patients according to Dr. Y.'s method can only attribute it to luck if he escapes committing serious error."

The first chapter of the monograph discussing "Simple Obesity in Otherwise Healthy Subjects," does not prove very satisfactory. Although certain general principles are laid down, they are subsequently so modified and curtailed that few, if any, cases seem to furnish the indications for reduction. The rule is given that *advanced degrees* of obesity present the indications for reduction cures when there is interference with the health of the patient. But the author immediately excludes young persons from the list and insists that in them you should be content to prevent further progress of obesity; while reduction cures in old age are always to be avoided since they accelerate decay. This would seem to leave to the middle-aged alone the right to indulge in reduction cures. Yet not so, since even in them all measures aiming at reduction are counter-indicated if they have been obese for several decades.

Medium degrees of obesity are not discussed with more certainty, and *slight degrees* furnish no indication for reduction other than vanity. Still, this is considered good and sufficient ground for treatment, inasmuch as refusal from a physician would merely drive his client into the hands of some quack.

The second chapter deals with "Obesity Complicating Other Diseases," and contains much of value. In all those cases where increased work is already thrown on the heart, as in valvular disease, arterio-sclerosis, emphysema, etc., the deleterious effects of excessive fat are of such importance that reduction becomes one of the most essential features of their therapy. This is best accomplished by the intermittent cures. These consist in allowing about one month to intervene between the periods in which the patient is kept under strict regime. The only renal disorder that is of importance in this connection is the contracted kidney. Since prognosis here depends on the functional power of the heart the same rules apply as in circulatory diseases.

Among the other conditions mentioned, the most important is gout. Von Noorden considers this to be favored with a good prognosis in the fat and only advises reduction in cases where there is large destruction of articular tissue or where some lesion is associated which renders obesity dangerous. Likewise, in diabetes mellitus "cures" are out of place, for fat here is usually a protection against the serious dangers of the malady.

Finally it is pointed out that forced feeding in pulmonary tuberculosis is not an unmixed good if carried far enough to allow the patient to become obese. Excessive fat leaves no room for

healthy development of muscle, which would guarantee a far better outlook.

As a whole the monograph is somewhat disappointing, coming from such an authority on pathological metabolism, for it fails to give the definite advice that is welcome to the clinician. In some parts, however, as where circulatory disorders are discussed, the statements are clearly and concisely made, are evidently the result of wide observation and will repay very well those who give them heed.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By PROF. DR. CARL VON NOORDEN. Authorized American edition, translated under the direction of BOARDMAN REED, M. D., Philadelphia. Part II. Nephritis. (*New York: E. B. Treat & Co., 1903.*)

The monograph is based on the clinical observations of the author as well as on the studies in metabolism which have been pursued by him and his pupils through a number of years. Such investigations must supply the foundation for any rational therapy in nephritis. The various end products of metabolism have been studied and are described as fully as could be expected in such a volume, with reference to their derivation, toxicity, ease of elimination and quantity normally excreted. Applications of these facts to the treatment of nephritis take up the last two chapters of the book.

The customary routine in the management of nephritis of all types is assailed with some violence. Drugs are assigned a very limited sphere. Radical changes in the diet are recommended. These look toward the least possible allowance of nourishment in acute nephritis, while in the chronic type the author favors much greater latitude than is usually permitted. Among other innovations is the addition of dark meat to the diet in this condition.

The use of milk, so time-honored in all varieties of nephritis, is greatly curtailed. Its relatively high albumin content ultimately throws into the circulation large quantities of urea, which has been found very difficult of elimination. The trouble is met at least in part by the use of a super-fatted milk. This furnishes a much more nutritive mixture than plain milk without any increase in the proteid. Another unfavorable quality of milk is due to its large proportion of phosphoric acid. In order to avoid the deleterious effect of this on the kidney, the addition of calcium carbonate is suggested, which will minimize the absorption of phosphates from the gastro-intestinal tract.

Von Noorden reaches the acme of iconoclasm in urging very strongly the limitation of water for nephritic patients. He holds that under some circumstances the kidneys find nothing harder to eliminate than water and that it always throws unnecessary work on these organs when given in quantities indiscriminately large. The stand he takes is certainly extreme and largely opposed to clinical experience. Cases are not uncommon in which the ingestion of fluids, in amounts that he calls excessive, is followed by free diuresis and with it an amelioration or disappearance of toxic symptoms.

Boldness is one of the chief characteristics of the monograph and at times its assertions are so far from the present-day teaching and practice that they are sure not to meet with immediate acceptance. Yet, wherever the author's views fail to secure endorsement, they will command respect and stimulate investigation.

The volume seems to us one of considerable significance, and it is to be deeply deplored that the work of the editor and printer has been very poorly done. From the incorrectly spelled name of the author on the cover to the last chapter in which the pages are almost hopelessly mixed with those of the preceding chapter, the book abounds in errors, not found in the original.

Diseases of the Heart and Arterial System. By ROBERT H. BABCOCK, A. M., M. D., Professor of Clinical Medicine and Diseases of the Chest, College of Physicians and Surgeons, Chicago. With three colored plates and one hundred and thirty-nine illustrations. (*New York and London: D. Appleton & Co., 1903.*)

This work is abreast in modern and recent ideas, moulding the thoughts of the masters with the skilled hand of experience, adding freely from keen personal observation.

Anatomy and physiology have been but briefly touched upon; space is rather reserved for a concise and well arranged expositions of conditions of disease.

The prognosis and treatment of valvular heart disease are given relatively much space and the subject is handled in a very detailed and painstaking manner. These chapters alone will commend the work to that large body in the profession who practice general medicine, who represent the average worker rather than the teacher, and to whom heart cases, though not frequent, as in hospital practice, are a source of careful study and never-ceasing anxiety.

Dr. Babcock values the Nauheim home treatment in private practice, fully satisfied that he has obtained definite results in reduction of area of cardiac dullness, and in favorable cases of mitral stenosis of the second degree (Broadbent) he has restored the second apex sound by baths and resistance exercises, and obtained great general improvement.

The ideas of the author on acute endocarditis are made to correspond to present pathology, recognizing both simple and ulcerative forms as usually of bacterial origin; malignancy depending upon the virulence of the infecting organism.

The importance of the mildest rheumatic, choreic or tonsilar attacks receives sufficient attention as common causes of endocarditis.

A few pages are granted the rare but interesting subject of pedunculated and ball thrombi of the heart, brought to notice by Welch in his article in Allbutt's system.

One is impressed as he advances through this valuable book that the author has endeavored to sacrifice nothing of the scientific, though writing for the bedside workers in the profession and that diagnosis and treatment have been foremost in his mind.

The Surgical Treatment of Gastric and Duodenal Ulcers. By B. G. A. MOYNIHAN, M. S. (London), F. R. C. S. Eng., Senior Assistant Surgeon, Leeds General Infirmary. Illustrated. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903*).

This is an unusually attractive little volume as regards binding, paper and print. Its text is practically identical with that of the paper by the same author entitled "The Surgery of the Simple Diseases of the Stomach," read at the recent meeting of the American Surgical Association, to which is added a minute tabulation of the cases upon which he has operated.

The author confines himself to a discussion of his own experience with such ulcers, dealing with the subject under the following headings: (1) Perforation of Gastric or Duodenal Ulcers. (2) Hæmorrhage. (3) Chronic Ulcer. (4) Hour-glass Stomach.

He is an ardent advocate of gastro-enterostomy, rather than pyloroplasty or excision of the ulcer, in the treatment of gastric ulcers and hæmorrhages arising from them. His results seem to justify this, for practically all of his cases had an uninterrupted convalescence.

It is to be regretted that a brief summary of his cases, with deductions therefrom, was not substituted for the extensive tables at the back of the book.

The Practical Medicine Series of Year Books, comprising ten volumes on the Year's Progress in Medicine and Surgery. Under the general editorial charge of GUSTAVUS P. HEAD, M. D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Volume V. Obstetrics. Edited by REUBEN PETERSON, A. B., M. D., Professor of Obstetrics and Gynecology, University of Michigan. (*Chicago: The Year Book Publishers, 1903.*)

This work "purposes placing at the command of the general practitioner the subject-matter covering advances made in this department during the past year, and in such a form as to aid him in practical work."

The subject-matter consists of abstracts of articles that have appeared in the best French and German journals and in English and American journals of more or less prominence. These are arranged without comment often, and with total disregard for their relative importance.

Certain sections, notably those dealing with the placenta, extra-uterine pregnancy, and obstetrical operations, contain much that may be of interest, but little that will be of practical value. It is unfortunate that the series of articles dealing with the Bossi dilator gives but one view of the German obstetricians, whose enthusiastic approval of this dangerous instrument has not been shared by any of the best French, English or American obstetricians.

There is little or nothing on that most important subject Hæmorrhage, while the section on Infections is devoted largely to discussion of treatment and contains much that is neither new nor progressive.

Of the illustrations, the best that can be said is that they are few in number.

The Practical Medicine Series of Year Books. Volume IV. Gynecology. Edited by EMILIUS C. DUDLEY, A. M., M. D., Professor of Gynecology, Northwestern University Medical School, and WILLIAM HEALY, A. B., M. D., Instructor in Gynecology, Northwestern University Medical School. (*Chicago: The Year Book Publishers, 1903.*)

The above named volume constitutes Volume IV of the Practical Medical Series of Year Books for the current year. The editors, Emilius C. Dudley and Wm. Healy, state in its introduction that they have endeavored to review the best practical literature of gynecology for the year beginning February 1, 1902. In addition to the abstracts Dr. Dudley has added in many places editorial comments. These are very instructive and it is to be regretted that they are not more frequent. The book as a whole accomplishes its purpose, which, as expressly stated, is to furnish a busy practitioner, and presumably the one with limited time for reading, with the current literature. There has been no attempt to make a complete year-book and it is plainly stated that such anatomical and pathological contributions as have been made are outside the scope of this book. In the main the selection of articles has been excellent and the abstracts themselves have been well made.

In looking through the literature one finds, as might be expected in such a book, that many articles have been left out. For example, extra-uterine pregnancy is not considered. A number of articles on this subject appeared during the year and to completely ignore them seems a real omission. In the opinion of the reviewer the treatment of carcinoma of the cervix is also insufficient. A more complete consideration of the proceedings of the International Congress at Rome in reference to this subject should have found place. The reports made there by the advocates of the radical abdominal operation are exceedingly suggestive and interesting. A number of other good papers have not been reviewed, but the above-mentioned seem the most important omissions.

The volume has been printed and bound to conform with the other volumes of the series. It contains 237 pages. Considered from the standpoint from which it was written, it can be thoroughly recommended as a useful book.

The Practical Medicine Series of Year Books. Volume II. General Surgery. Edited by JOHN B. MURPHY, M. D., Professor of Surgery, Northwestern University Medical School. (*Chicago: The Year Book Publishers, 1902.*)

This book of 520 pages is one of a series of ten volumes constituting the Practical Medicine Series of Year Books which were issued monthly under the general editorial supervision of Gustavus P. Head, Professor of Laryngology and Rhinology in the Chicago Post-Graduate Medical School. It reviews fully the more practical articles relating to surgery which appeared during the year preceding its publication in November, 1902.

Dr. Murphy has abstracted and classified over five hundred papers. Considerable space has been given to gall-bladder, gastro-intestinal, appendix and kidney surgery. There are no references to surgical pathology. Purely theoretical and experimental studies have not been reviewed. Only an occasionally parenthetical editorial opinion has been proffered.

To medical men who desire a summary working knowledge of the literature of practical surgery the book will be useful.

Surgical Diseases of the Kidney and Ureter, including Malformations and Misplacements. By HENRY MORRIS, M. A., M. B., London, F. R. C. S., etc. In two volumes, containing together 1352 pages, with two colored plates and upwards of two hundred engravings. (*London, Paris, New York, Melbourne: Cassell & Co., Limited; Chicago: W. T. Keener & Co., 1903.*)

This work is in no sense fragmentary like a series of monographs, but rather a systematic treatise. It represents the best that is known concerning its subject-matter. The writer has not only presented to the medical profession the results of his extensive experience in the surgery of the kidney and ureter, but has also combined with it an exhaustive study of the writings of others. The volumes are well arranged and, what is of great importance in a work of reference, they have a good index. One can only regret the more that in a work otherwise so complete a bibliography should be lacking.

Part I, treating of surgical diseases of the kidney, occupies three-fourths of the two volumes. It is impossible to review each of the several chapters, and we must content ourselves with the statement that the entire subject is systematically, carefully and adequately treated.

Part II is devoted to surgical diseases of the ureter, and here one finds a similar thorough treatment of the subject as in Part I. In this connection it is of interest to note the author's objections to ureteral catheterization as stated on pp. 324-329, Vol. II, which are thus summarized:

1. The obnoxious nature of the operation in the female and the extreme difficulty of it in the male.
2. The unreliableness of the information it affords.
3. The risks to which it exposes the patient.
4. The disadvantages of it as a mode of treatment.

Under the first objection he speaks of the positions in which women are placed as "very revolting to the finer feminine sense," unless the patient is under an anæsthetic, which hardly seems a valid objection to a most important and valuable means of investigating the condition of the ureters and kidneys. New methods and greater manual dexterity in the operation, the result of practice, have done much to remove this objection, and we cannot avoid suggesting as a possible reason for it on the part of the author a lack of personal experience with the details of

ureteral catheterization. The allegation that the information afforded by catheterization is unreliable is supported by cases where a nephro-ureterectomy had been done because a diagnosis of tuberculosis of the ureter and kidney had been made by the cystoscope and ureteral catheter. After the removal of the kidney and ureter it was found upon a careful study of the specimen that the tuberculous process had been limited to the kidney and that the ureter was not involved in disease. Granting the utmost weight to this objection, in this connection it has little practical value, because the ureter is certainly a useless organ without a kidney attached to it. Even if it had been a grave error on the part of the surgeon and one which might have been followed by a more serious consequence, the possibility of such an error does not constitute a valid argument against the operation itself in skilful hands. We should not think of discarding the use of the microscope because a physician may make the diagnosis of cancer of the uterus from curettings which the after-removal and examination of the uterus may have shown to be erroneous.

Nor is the danger to which a patient may be exposed by reason of such catheterization as serious an objection as the author believes. Under proper care the risk to the patient is very slight and not to be thought of when its great value as a means of diagnosis is considered. It should certainly not be condemned absolutely as a mode of treatment because it may have been employed in unsuitable cases. We quite agree with the author that the reimplantation of a ureter in the bladder in cases where the stricture is situated at or near the bladder is preferable to attempting to dilate the stricture by ureteral catheters and also that a pyo-nephritic kidney containing calculi or filled with "masses of pus and old partially disorganized blood clot" cannot be cured by irrigating the kidney *through a ureteral catheter.*

While, therefore, we may not agree with the author in some of his conclusions, we cannot omit to express our appreciation of the completeness and thoroughness of the book. It is unquestionably the most satisfactory treatise on this important branch of surgery in the English language. It deserves to be widely known and read.

The Care of the Baby: A Manual for Mothers and Nurses. By J. P. CROZER GRIFFITH, M. D. Third edition, thoroughly revised. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

There could be no more substantial appreciation of Dr. Griffith's book than the need for a third edition. He has given a comprehensive treatment of matters that pertain to the mother's care of the baby in a style at once clear and concise, well adapted to the popular reader. The volume is genuinely good throughout and merits the prominent place it holds among books of its class.

Very few changes have been made in this edition. Indeed, few were needed. Here and there a sentence or two has been inserted to amplify or modify the text of the former edition, but no radical departure occurs. The most noteworthy addition is in the chapter on the sick baby, which has been extended to include a discussion of the following conditions: Bow Legs, Influenza, Heart Disease, Scurvy, Lip-sucking, Dirt-eating, and Round Shoulders.

The teaching of the book is not open to criticism save in a few places. We feel the umbilical cord is best kept from danger of infection through the use of a dry dressing and never by means of "washing of the navel" with "water dropped upon it from cotton." The advisability of placing a thermometer in the hands of an anxious mother with instruction to take the baby's temperature often is questionable. The instrument is sure to give rise frequently to unnecessary discomfort both to mother and to child, and in all probability would never give evidence of sickness before the appearance of symptoms attracting the mother's notice.

The book abounds in information of the greatest practical value to the young mother, and should be brought to her attention by the physician. It is a clear exposition of the knowledge that comes from large personal experience and will go far to counteract the ignorance, neglect and bad management accountable for many of the derangements of infancy.

Modern Materia Medica and Therapeutics. By A. A. STEVENS, A. M., M. D., Lecturer on Physical Diagnosis in the University of Pennsylvania; Physician to the Episcopal Hospital and to St. Agnes' Hospital; Fellow of the College of Physicians of Philadelphia, etc. Third edition, entirely re-written, pp. 663. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

The first 460 pages deal with Materia Medica proper, the drugs being arranged and discussed according to their physiological action. The remaining 150 pages are devoted to remedial measures other than drugs and to applied Therapeutics. The author has presented a very acceptable book on the subject.

A Text-Book of Legal Medicine and Toxicology. Edited by FREDERICK PETERSON, M. D., President of the New York State Commission in Lunacy; Chief of Clinic, Department of Nervous Diseases, Columbia University; General Consultant to the Craig Colony for Epileptics, Sonyea, New York, and WALTER S. HAINES, M. D., Professor of Chemistry, Pharmacy and Toxicology in the University of Chicago. In two volumes. Volume I, p. 730. (*Philadelphia, New York, London: W. B. Saunders & Co., 1903.*)

The appearance of this excellent book is indeed opportune, as there is a demand for a comprehensive book of about this size and bringing the subject-matter up to date.

The contributors have produced a work of interest and value written in a clear, readable style.

The work includes two chapters which are rather unique—one on "The Destruction and Attempted Destruction of the Human Body by Fire and Chemicals," and the other on "The Medico-Legal Aspects of the X-Rays." This latter will appear in Vol. II.

Throughout the work many of the most interesting recent cases are cited, and the book will be a great aid to both the medico-legal expert and the advocate.

A Handbook of Materia Medica, Pharmacy and Therapeutics, including the Physiological Action of Drugs, the special Therapeutics of Disease, Official and Practical Pharmacy, and Minute Directions for Prescription Writing. By SAM'L O. L. POTTER, A. M., M. D., M. R. C. P., London. Ninth edition revised and enlarged, pp. 951. (*Philadelphia: P. Blakiston's Son & Co., 1902.*)

The general character of this book is the same as that of the previous editions, but much has been rewritten and much new matter added. The fact that the book has passed through nine editions since 1886 would indicate that it has a place and has been well received. As a treatise on Pharmacology it is not at all comprehensive. Such questions as the fate of drugs in the body are not discussed and numerous facts of theoretical and biological interest are omitted. Hence it can in no sense replace our text-books of Pharmacology proper. On the other hand it contains a very great deal of valuable material expressed in a very clear phraseology and in most convenient form for ready reference. It will, therefore, be a valuable addition to the library, especially of the medical student.

Anatomy of the Brain and Spinal Cord. With Special Reference to the Grouping and Chaining of Neurones into Conduction Paths. By HARRIS E. SANTEE, M. D., Ph. D., Chicago. Third edition. (*Chicago: E. H. Colegrove, 1903.*)

The work is designed to serve as a text-book for medical students and at the same time to be of use to practitioners. It is written in good style, is readable, and lacks the usual dullness of works on anatomy. It is brief and clear, though not always accurate. The special feature of the book is the attempt to make the main divisions of the brain, as for example the mid-brain, or the medulla, stand out by means of the form and the functions of the tracts they contain. The references to function are a distinct addition. The descriptions are graphic, as for example, the form of the internal capsule as a funnel opening outward; nevertheless it is difficult to get a complete picture of the long tracts when described in so many segments. This is especially true of the sensory tract. Any attempt to give the student a picture of the tracts of the central nervous system as a unit, rather than as an area in a microscopic section, is an advantage, but to describe so complex a structure as the brain without illustrations is an exceedingly difficult task. The new nomenclature is not used in the text, but is introduced in footnotes. By placing the embryology at the end the development of the brain is not made an integral part of the general treatment of the subject, a decided disadvantage from the point of view of teaching.

BOOKS RECEIVED.

Surgical Diseases of the Kidney and Ureter. Including Injuries, Malformations and Misplacements. By Henry Morris, M. A., M. D., Lond., F. R. C. S. With two colored plates and upwards of two hundred engravings. In two volumes. 8vo. 1901. Cassell and Company, Limited, London, Paris, New York and Melbourne.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By Prof. Dr. Carl von Noorden. Authorized American edition, translated under the direction of Boardman Reed, M. D. Part I. *Obesity*, the Indications for Reduction Cures. 1903. 8vo. 59 pages. E. B. Treat & Co., New York.

Clinical Treatises on the Pathology and Therapy of Disorders of Metabolism and Nutrition. By Prof. Dr. Carl von Noorden. Authorized American edition, translated under the direction of Boardman Reed, M. D. Part II. *Nephritis.* 1903. 8vo. 112 pages. E. B. Treat & Co., New York.

Saint Bartholomew's Hospital Reports. Edited by Norman Moore, M. D., and D'Arcy Power, F. R. C. S. Vol. XXXVIII, 1902. 8vo. XXXVI + 258 + 206 pages. 1903. Smith, Elder & Co., London.

Diseases of the Skin. Their Description, Pathology, Diagnosis and Treatment, with Special Reference to the Skin Eruptions of Children, and an Analysis of Fifteen Thousand Cases of Skin Disease. By H. Radcliffe Crocker, M D. (Lond.), F. R. C. P. Third edition, revised and enlarged. With four plates and one hundred and twelve illustrations. 1903. 8vo. 1446 pages. P. Blakiston's Son & Co., Philadelphia.

The American Year-Book of Medicine and Surgery. Collected and arranged with critical editorial comments by J. M. Baldy, M. D., J. Chalmers Da Costa, M. D., *et al.* Under the general editorial charge of George M. Gould, M. D. Vol. II. Surgery. 1903. 8vo. 671 pages. W. B. Saunders & Co., Philadelphia, New York, London.

The Internal Secretions and the Principles of Medicine. By Charles E. de M. Sajous, M. D. Volume First. With forty-two illustrations. 1903. 8vo. 800 pages. F. A. Davis Company, Philadelphia.

Proceedings of the American Medico-Psychological Association. Fifty-eighth annual meeting held in Montreal, Quebec, June 17-20, 1902. 8vo. 333 pages. Published by the American Medico-Psychological Association.

How to Succeed in the Practice of Medicine. By Joseph McDowell Mathews, M. D., LL. D. 1902. 8vo. 215 pages. John P. Morton & Co., Louisville.

Biographic Clinics. The Origin of the Ill-Health of De Quincey, Carlyle, Darwin, Huxley and Browning. By George M. Gould, M. D. 1903. 12mo. 223 pages. P. Blakiston's Son & Co., Philadelphia.

The American Year-Book of Medicine and Surgery. Collected and arranged with critical editorial comments by Samuel W. Abbott, M. D., Archibald Church, M. D., *et al.* Under the general editorial charge of George M. Gould, M. D. Vol. I. Medicine. 1903. 8vo. 691 pages. W. B. Saunders & Co., Philadelphia, New York, London.

A Laboratory Text-Book of Embryology. By Charles Sedgwick Minot, LL. D. (Yale), D. Sc. (Oxford). With 218 illustrations, chiefly original. 1903. 380 pages. P. Blakiston's Son & Co., Philadelphia.

A Manual of Practical Hygiene. For Students, Physicians and Medical Officers. By Charles Harrington, M. D. Second edition, revised and enlarged. Illustrated with twelve plates in colors and monochrome, and one hundred and thirteen engravings. 1902. 8vo. 760 pages. Lea Brothers & Co., Philadelphia and New York.

The International Medical Annual. A Year Book of Treatment and Practitioner's Index. Twenty-first year. 1903. 12mo. 739 pages. E. B. Treat & Co., New York and Chicago.

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DR. SAMUEL FULLER, OF THE MAYFLOWER (1620), THE PIONEER PHYSICIAN.*

By Thomas F. Harrington, M. D., *of Lowell, Mass.*

There is no epoch in modern history more eventful to the medical profession than that marking the closing of the sixteenth and the beginning of the seventeenth centuries. The discovery of America, the extension of the printing-press, the awakening of scientific thought and inquiry, all foretold a new era in the world's history, which should forever stand forth illumining by its warm rays all future ages. The light of reason and skepticism was to be as destructive to the demon theory of disease which had prevailed from the Middle Ages as its stimulating influences were to be beneficial to progress and advancement. The age found the man, and from the University of Basel (1526) the clear voice of Paracelsus (1493-1541) rings forth bidding the fettered mind to awake and come out of the darkness. Truly this was a wonderful man. However much we may find to condemn in his teachings and methods, his truths will ever serve as the foundation to successful medicine. "Reading never made a doctor," he said, "but practice is what forms a physician. For all reading is a foot-stool to practice, and a mere feather broom. He who meditates discovers something." Again he says, "The book of nature was that which the physician should read, and to do so he must walk over its leaves." His ætiology of diseases was divided into five causes: foul air, errors in digestion and assimilation, diathesis, disorders due to perverted ideas, and lastly diseases due to causes predetermined by God.[1]

His discoveries included metal zinc and hydrogen gas; he invented laudanum, and he anticipated the transfusion of blood; he substituted tinctures and quintessence of drugs for the filthy masses and unscientific mixtures; he introduced mercury for the treatment of syphilis, and the use of iron, sulphur, antimony, arsenic, tin and lead, as well as baths, also arnica and other vegetable remedies in the treatment of disease; he revolutionized the barbarous treatment of dislocations and fractures, honor enough, one might think, for one man. Greatly as it would profit us to dwell at some length upon the life and works of Paracelsus, the purpose of introducing him here is to point out the influence at work in the scientific world tending to produce abundant good fruit. For this result we do not look in vain. Electricity, chemistry, mineralogy, botany and pharmacy all advanced rapidly, each giving its due quota to medicine for the betterment and uplifting of mankind.[2] The medical profession received its first legislative recognition by Parliament (1511), physicians and surgeons were exempted by law (1542) from military and jury duty in order that they might be the freer to attend to their duties, colleges for the instruction of medical students were established, and laws against irregular practitioners and quacks were enacted (1542).[3] The labors and investigations of Vesalius (1514-1564), Fallopius (1523-1562),

* Read before the Johns Hopkins Historical Club, April 20, 1903.

Eustachius (1510-1574), Servetus (1511-1553), and Ambrosie Parè (1517-1590) had awakened the medical mind to the study of anatomy, physiology and surgery such as had never been done before, and plainly foretold almost to anticipation the great discovery of Harvey (1578-1657) which meant the establishment of the theory and practice of medicine upon a new and permanent foundation. Kepler (1571-1630), Galileo (1564-1642), Reubens (1577-1640), Francis Bacon (1561-1626), and Shakspear (1564-1616) were entering upon the world's stage, there to leave, each in his own sphere, a model which would stand for all ages. Providence seems to have decreed that from that age one should be born whom the followers in the new world of His works as exemplified by the Apostle Luke should find worthy of emulating.

Samuel Fuller was baptized at Redenhall Parish Church, in Norfolk county, England, January 20, 1580.[3] He was the son of Robert Fuller, who is registered as a butcher, which was ranked with the trades and professions. That the Fullers were prominent people in the parish for more than one hundred years prior to Samuel Fuller's birth is evident from the records. Unfortunately the custom of that age did not include mentioning the name of the mother in the registry of births, consequently little is known of Mrs. Fuller's ancestry. Information as to the early life and doings of young Fuller is very meagre. It is stated, however, that he had been a silk worker,[4] whether as an apprentice to some Frenchman as his friend and companion William Bradford was, can only be conjectured; positive it is, however, that at some time in early youth these two young men formed a companionship which makes it impossible to consider their lives separately. Samuel Fuller's marked career began at Leyden, where he is early spoken of as one of the deacons of that church[5] which was soon to play such an important part in the settlement of the new world. This office of deacon was not an empty one, for the deacons of the church, though laymen, were as carefully selected and formally ordained as the clergymen. Previous to coming to Leyden he had married Elsie Glascock, probably in England,[6] who lived but a short time, and in 1613, according to Leyden records, he married Agnes, daughter of Alexander Carpenter, a family of such superior position that the suit of William Bradford for the hand in marriage of another daughter, Alice, was not looked upon with favor, notwithstanding the fact that Bradford belonged to the two best families in his section. Bradford afterwards married Alice in America (August 14, 1623). Soon death again robbed Deacon Fuller of his wife, and he married his third and last wife, Bridget, daughter of Mrs. Joseph Lee, at Leyden, 1617.

Of his life at Leyden much is known. He was reckoned as one of the persons of large means,[7] and both on account of his blood and marriage connections with many of the leading families of Rev. John Robinson's congregation, as well as the power of his own force of character, he early became an active and important factor in the affairs of that band of Separatists.[8] Fuller joined the Scrooby band of Pilgrims at Leyden in 1609, where they had gone after leaving Amsterdam. This settlement included William Bradford, John Robinson, William Brewster, Isaac Allerton, Edward Winslow, John Carver, Miles Standish, William White, as well as others, all of whose names to-day are so familiar in the history of the first settlements in this country. In the negotiations and preparations for fitting out the Speedwell and the Mayflower (1617-1620) Fuller was an active and influential party. [9] He was the first signer to the letter written jointly by Fuller, Winslow, Brewster and Allerton to Carver and Cushman, date June 10 (new style), 1620, in which they sharply criticise Cushman's actions in his dealings with the Virginia Company and later with "the Merchant Adventurers" while acting as the agent for the Pilgrims.

For more than twenty years prior to the emigration of the Pilgrims from Leyden the Puritanic clergy were educated to the medical profession [10] in anticipation of their pilgrimage which persecution at home was surely forcing upon them. Oxford, too, foreseeing the difficulties in store for the clergy, incorporated the study of physic in the course for the divinity student. A part of this education consisted in the study of the ancient medical authors, as Hippocrates, Galen, Breteus, Celsus and others. Thus it was that many clergymen were eminent practitioners of medicine before they crossed the Atlantic, where necessity often forced the two duties into one. William Brewster, with whom Fuller was closely associated at Leyden, was a man of great learning and ability. In his capacity as secretary to Davison, one of Elizabeth's ambassadors and secretary of state, Brewster had many opportunities for study. He became a noted teacher and so magnetic was his style that students from all quarters came to the famous Leyden University to partake of his knowledge. His methods attracted the attention of many of the eminent men of that period. Bradford speaks of Leyden as "a fair & bewtifull citie, and of a sweet situation, but made more famous by ye universitie wherwith it is adorned, in which of late had been so many learned men." Fuller was indeed fortunate in having the friendship and association of this man, especially at Leyden, and at a time when great discoveries were being made in the field of medicine. In 1616 Harvey first expounded to his students the circulation of the blood which he published to the world twelve years later. [11] Aided by the discovery of the microscope in 1621, the doctrine of Harvey on the development of the higher animals from the ovum, as well as the acceptance of his description of the circulation of the blood, a new era was commenced in medical science which meant a complete overthrow of the followers of the Ancients, and one which effected a total revolution in the theory and practice of medicine. The science of medicine became greatly interwoven with the science of philosophy, thus broadening the human mind. Investigation and experiment supplanted dogmatism and blind faith; human dissection which had slept for fifteen centuries was revived; anatomy and physiology were studied by means of actual dissections; many new remedies were introduced in the treatment of disease, including lemon juice for scurvy, Peruvian bark for malaria, as well as sarsaparilla and guaiacum. The in-

struction of medical students in England was mostly confined to the guilds, and consisted of lectures and demonstrations in dissections for which the government furnished bodies. Besides these compulsory lectures there were many private and endowed courses. Harvey was lecturer for forty-one years (1616-1656) in one of these courses (the Lumleian [13]), and it was here that he first made known his discovery. Medical publications were scarce and subjected to the closest censorship. Surgeons and barbers were now recognized as separate bodies.

Surrounded by such conditions and afforded every opportunity to take the fullest advantages of his privileges, it is but reasonable to suppose that an active, energetic, studious mind, such as we know Samuel Fuller to have possessed, must of necessity become well equipped for his chosen work. In forming an estimate of Doctor Fuller two sources of error confront us. First we are apt to consider him as a clergyman who had studied medicine and who was not a regularly educated physician, and secondly the too commonly accepted belief that superstition, astrology and ignorance predominated at that time. Now as to the first it can be positively said that while he was well educated in clerical matters, his profession was medicine, and it was as physician and not as minister that he came to America. There is perhaps no stronger proof of this than the words of Pastor Robinson in his final letter to his brother-in-law, John Carver, just before the Mayflower sailed (July 27, 1620). He says: [13] "... I have written a large letter to ye whole, and am sorrie I shall not rather speak than write to them, & the more considering ye want of a preacher, which I shall also make sume spurr to my hastening after you. . . ." In the list of the passengers sailing on the Mayflower the occupation of Samuel Fuller is given as Physician, and "the vocations given were, as far as ascertained, the callings the individuals who represented them had followed before taking ship." [14] Dr. Thacher in his memoirs says: [15] "The first physician of whom we have any account among the Colonists was Dr. Samuel Fuller. . . . Whether he had enjoyed a collegiate education is uncertain, but he is said to have been well qualified in his profession; he was zealous in the cause of religion, and eminently useful as a physician and surgeon." An account of the sickness in Governor Endicott's Settlement at Salem in 1628 says: [16] "Having no physician among themselves, it was fortunate for those planters that Plymouth could supply them with one so well qualified as Dr. Fuller." From these accounts as well as the numerous evidences of his learning and skill found in his life and labors in this country, it must be acknowledged that Dr. Samuel Fuller was a worthy representative of the medical profession of that period.

Previous to the coming of the Mayflower, Dr. Wotton (1606), Dr. Russell (1607) and Dr. Bagnall (1608) had accompanied expeditions to Virginia, and served as surgeon to Captain John Smith's party. History does not record how long they remained in this country. That none of them settled here would seem positive from the account given by Smith, who says [17] that he was compelled to return to Europe for the recovery of his health in 1609 after being badly wounded by the explosion of gunpowder, as there was neither chirurgeon nor chirurgery at the fort. In 1610 Dr. Bohun came to this country, and in 1611 he accompanied Lord Delaware to the West Indies. He was killed in a fight with a Spanish warship. It has been said that the Mayflower had a surgeon (Giles Heale), but nothing is recorded about him other than his signature to William Mullins' will. Mullins died February, 1621, on the Mayflower. There is no other mention of this surgeon either as a passenger or sailor on board the Mayflower. Therefore I think that it can be positively said that Dr. Samuel Fuller was the first physician to settle in the colonies and the pioneer English-speaking physician of this country.

As to the mental outfit of the early colonists much might be said, praiseworthy and otherwise. Astrology was the science that touched the popular imagination. Medicines were given when the moon was in the proper sign; horoscopic diagnoses were common practices; weaning of infants on the proper sign of the zodiac was the rule, all remnants of the influences surviving from the Middle Ages. Superstition had its believers even among the educated, yet the very influences thought to be the greatest hindrance to advancement, namely, the lack of opportunities for book learning, the absence of newspapers, periodicals and journals to spread the knowledge gained as well as the exigent wants of the people, were all factors in compelling close observation in their new surroundings, and a keen stimulant to the desire for schools and churches upon which to build a government indestructible. That Doctor Fuller was one of those equipped with the mental training suitable to enable him to make the best of his new environment must be admitted. In a time when the very suspicion of possessing medical skill made it dangerous to be thus recognized it speaks strongly of Dr. Fuller's courage and high-mindedness to be looked upon as the one person best qualified in the knowledge of medicine. A small ship of about 60 tons was fitted out in Holland and was to accompany the Mayflower to this country. Dr. Fuller was evidently not a passenger on this ill-fated ship, for an account of the sailing (about July 22, 1620) says: [18] "just who of the Leyden chiefs caused themselves to be assigned to the small vessel (Speedwell) to encourage its cowardly Weston cannot be definitely known. It may be confidently assumed, however, that Dr. Samuel Fuller the physician of the colonists was transferred to the Mayflower upon which were embarked 3/4ths of the entire company, including most of the women and children, with some of whom it was evident his services would be certainly in demand." There appears to have been very little sickness, other than seasickness, among the passengers during that long and trying voyage. One of the seamen, an able-bodied man much given to profanity, was stricken with a "grieveous disease of which he dyed in a desperate manner, and was ye first yt was throwne overboard." [19] Whether this was a case of delirium tremens [20] no positive knowledge exists. Two weeks later on the day before land was sighted the second death occurred. This was William

Butten, the servant-student to Dr. Fuller, and he was the only passenger who died on the voyage. Dr. Fuller, unlike all the other leaders, did not bring his wife and family with him. His only attendant was the youth Butten who is designated in the Log Book as "servant-assistant to Dr. Fuller." The fact that there was very little sickness on the Mayflower speaks well for the physical condition of the party, which is said by Winslow "to be the youngest and strongest of the Leyden congregation." That there were troubles other than sicknesses against which the leaders had to contend would appear from the following: "This day before we came to harbor observing some not well affected to unity and concord, but gave some appearance of faction, it was thought good there should be an association and agreement that we should combine together in one body, and to submit to such government and Governors as we should, by common consent, agree to make and choose, and set our hands to this that follows word for word."[21] This dissatisfaction arose on account of the abandonment of the location for settlement on territory under the protection of the patent granted by the London Virginia Company. Consequently on the 11th day of November, 1620, all the adult male passengers except two seamen, and those too ill, met in the cabin of the Mayflower and there drew up and signed the famous compact, a basis of civil self-government fame of which will never die. Samuel Fuller was the eighth signer of this memorable declaration. He was preceded in order by, first, John Carver; second, William Bradford, the leader and guide; third, Edward Winslow, the diplomat; fourth, William Brewster, the elder and scholar; fifth, Isaac Allerton, the active, progressive business man; sixth, Miles Standish, the Cincinnatus of the colony; seventh, Pilgrim John Alden, the young enthusiast.

Previous to sighting land Mistress Elizabeth Hopkins, wife of Master Stephen Hopkins, was delivered of a son, who, on account of the circumstances of his birth was named Oceanus, the first birth aboard the ship during the voyage. Later (November 27, 1620), Mistress White, sister to Dr. Fuller, gave birth to a son which is called Peregrine, the first child born in Cape Cod Harbor,[22] and the first-born English child in New England. There was another birth on the Mayflower December 22, 1620, while in Plymouth Harbor, son of Isaac Allerton, dead-born,[23] mother died February 25, 1621.

Scarcely had the Mayflower anchored in Cape Cod Harbor before sickness and death began their cruel work. Including the thirty-five days' stay in Cape Cod Harbor the voyagers had been one hundred and two days in coming from Plymouth, England, to Plymouth (New England), or one hundred and forty-five days from London. The condition of the Pilgrims did not improve after reaching Plymouth; their sickness and mortality can be best appreciated from Bradford's account; he says:[24] "But that which was most sadd & lamentable was, that in 2 or 3 moneths time halfe of their company dyed, espetialy in Jan: & February, being ye depth of winter, and wanting houses and other comforts; being infected with ye scurvie & other diseases, which this long vioyage & their inacomodate condition had brought upon them; so as ther dyed sometimes 2 or 3 of a day in ye foresaid time; that of 100 & odd persons scarce 50, remained. And of these in ye time of most distress, ther was but 6 or 7 sound persons who, to their great commendation be it spoken, spared no pains, night nor day, but with abundance of toyle and hazard of their own health, fetched them woode, made them fires, drest them meat, made their beads, washed their lothsome cloathes, cloathed & uncloathed them; in a word did all ye homly & necessarie offices for them wch deinty & quesie stomacks cannot endure to hear named."

Many guesses have been ventured as to the exact nature of this first illness. The overcrowding, the under-feeding, the trials, hardships and anxieties of the long voyage might be as favorable to the inception and development of one disease as another. There is every reason to believe that no infectious disease prevailed during the voyage. The only deaths were those of the seaman and William Butten, Doctor Fuller's assistant.

On November 11/21 a party of fifteen or sixteen men went ashore. On the 13/23 "many went ashore to refresh themselves, and the women to wash." An exploring party left on November 15/25, and was gone two days, during which time they followed Indians ten miles, found a store of buried corn and a big ship's kettle which they brought to ship. November 19/29 seamen went ashore. During all these trips it was necessary to wade in icy water up to the hips, and many are reported as having taken colds and coughs.

November 27/December 7, a party of twenty-four passengers, nine of the crew and the master of the ship, set out for land and a snow storm of six inches in depth forced them to remain on shore. They brought back corn, baskets, pottery, wickerware, etc., which they found buried in two graves and Indian houses.

December 4/14, the first death occurred, 17 days since the corn, kettle, etc., were brought on board. There were three deaths from illnesses as well as the death from drowning of Mistress Dorothy Bradford (December 7/17) during the thirty-five days the Mayflower lay in Cape Cod Harbor. The Mayflower reached Plymouth December 17/27, many reported sick, one of the Leyden party died December 21/31, another December 24/January 3. December 28/January 7, "Many ill from exposure." January 1/11, 1621, a death on Mayflower. January 8/18, another death. January 11/21, many ill aboard, Bradford and Carver ill on shore. On December 25, 1620 (January 4, 1621), the first house was started. It was about 20 feet square, and was a common rendezvous. It was principally used for the sick, and may be well considered to be the first hospital erected in this country. From this time the general sickness increased; there were 8 deaths during January, 17 during February, 13 during March, and 6 for the rest of the year. That the sickness was brought to the ship from shore would appear from Bradford's account, February 27/March 9: "The sickness and deaths of the colonists on shore have steadily increased, and have extended to the ship, which has lost several of its petty officers, including the master gunner, three quartermasters and cook,

and a third of the crew, many from scurvy." February 28/March 10, he says: "The fifty-third day the ship has lain in this harbor (Plymouth), and from the present rate of sickness and death aboard, no present capacity or prospect of getting away, those better being yet weak." March 24/April 3, "Many still sick, more on the ship than on shore." From this account it would appear that the sickness was of an acute, highly contagious nature, that it did not manifest itself until the passengers had gone ashore, drank the water, and brought corn and utensils from the Indian camps; that the sailors did not become ill until some of them had gone on the exploration with the passengers. Assuming the disease to be other than acute tuberculosis, which has been claimed to be the cause,[25] it must have been a disease whose period of incubation was from ten to twenty days. Scurvy we know existed, also acute coughs and colds, due to wetting and exposure, but Dr. Fuller, Bradford, Winslow and others, as well as the seamen, were well acquainted with the course of scurvy and would not fear it. It is not contagious, and there is little in the course of scurvy to suggest disgust in nursing the same. An argument against tuberculosis would appear from the fact that many recovered but were quite weak for some time, i. e., a slow convalescence. It is well established that the country about Massachusetts Bay had been swept by an epidemic of a very infectious disease two years before the landing of the Pilgrims. What that disease was can only be conjectured. Also in 1616 there had been a pestilence among the Indians which was thought to be either plague or smallpox, but which did not affect the English, although they lived and slept in the same cabins with the Indians.[26] Smallpox had been introduced into this country by the Spaniards in the early part of the sixteenth century.[27]

From the description gathered principally from Bradford's and Winslow's writings, as well as the history and course of the epidemic later at Salem, Charlestown and Dorchester, it would seem that the disease which caused the greatest mortality among the first settlers was either smallpox or typhus fever (plague), or a virulent form of typhoid. That there were cases of consumption, pneumonia, rheumatism and scurvy seems most natural under the circumstances. The most we know of the course of the sickness is that Bradford was reported very ill on January 11, 1621, and when he was elected as second Governor of Plymouth Colony in April, 1621, he was still too ill to take up the duties of the office. It is also known that the epidemic of sickness in 1634 was smallpox[28] and was fatal to many who had been exposed to the sickness in 1621. It is interesting to note that even at this early date consumption was considered a communicable disease. Frescatorius (1483-1553), who was the first to publish a description of typhus fever, says:[29] "Consumption is contagious, and is contracted by living with a phthisical person, by the gliding of the corrupted and putrefied juices (of the sick) into the lungs of the sound man." Measles and smallpox had been known from the middle of the ninth century.[30] From the knowledge which we possess of Dr. Fuller's education it is not unreasonable to assume that he was familiar with the writings and medical discoveries of the old writers. At London, and more especially at Leyden, he had every facility to consult their works. There is positive evidence that Doctor Fuller practiced bleeding, which was so universally employed at the beginning of the seventeenth century. Fuller did not limit his services to the settlers at New Plymouth. We find him dressing the wounds and curing the injuries of the Indians against whom Captain Standish proceeded in 1621. Also in 1622 upon the arrival of the Weston colonists, whom the Plymouth settlers had every reason to dislike, the sick and lame among them were left at Plymouth by permission of the Governor, although they had a surgeon in their party (Mr. Salisbury),[31] until their health was restored by Doctor Fuller, which he did without pay.[32] The wife and daughter of Samuel Fuller were passengers on the Anne in 1623. Two children were born in this country, Mercy, and Samuel who in 1694 was the first minister in Plymouth church. He had seven children, one of whom, Isaac, was the first physician in Middleboro. There is little to relate in the history of the Colony during the years 1623-1627. More or less sickness prevailed, yet there was no special epidemic. One event is recorded which shows that Doctor Fuller possessed a heart which was most tender and charitable towards his fellowmen. A certain Mr. Lyford came to the Colony in 1624 in the guise of a minister, but who in reality was a hypocrite and traitor. His scheming was frustrated and he was confronted with the evidence of his duplicity. At first he denied the charges, but later publicly confessed his sins in the church, and so great and sincere was the appearance of his repentance "that Samuel Fuller and some other tender-hearted men were so taken with his signs of sorrow and repentance, as they professed they would fall upon their knees to have his censure released."[33] Fuller's charity was misplaced, for Lyford's reformation did not last two months. In the affairs of trade and government of the Colonists, Doctor Fuller, although one of Governor Bradford's councillors, appears to have taken little part. He gave bonds with others, to the company of adventurers in England, yet he does not seem to be held by rigid demands of that bond. His mission and sacrifice were greater than that of worldly gain and his chief recompense was the love and gratitude of those who sought his sympathy and advice in their great trials, both physical and spiritual. When Bradford became Governor, Doctor Fuller was one of his selected councillors together with four others.

Doctor Fuller, unlike many of the early settlers, did not combine disputation nor bigotry with his religious views. To him a sick person was a call to duty, whether it came from Puritan or Pilgrim, Huguenot or Catholic, friend or foe, white man or Indian, all alike received the fullest measure of which he was capable. We are not surprised, therefore, to find him laboring among the Puritans of the settlements at Salem, also at Dorchester and Charlestown in 1628, '29 and '30. When Governor Endicott arrived in Salem there was much sickness of an infectious nature among the pas-

sengers. This sickness spread to those on land and many died, "Some of ye scurvie, other of an infectious feavure, which continued some time amongst them (though our people (the Plymouth settlement) escaped it." Endicott wrote to Governor Bradford begging the services of Doctor Fuller whom he had heard had "cured diverse of ye scurvie, and others of other diseases by letting blood, & other means." In view of the strained relationship which existed between the Pilgrims and Puritans up to this time Doctor Fuller's visit had an important bearing upon the affairs of the whole Colony. Governor Endicott wrote Governor Bradford, "I acknowledge myself much bound to you for your kind love and care in sending Mr. Fuller among us, and rejoice much that I am by him satisfied touching your judgments of the outward form of God's worship. It is as far as I can gather, no other than is warranted by the evidence of truth, and the same which I have professed and maintained ever since the Lord in mercy revealed Himself unto me, being far from the common report that has been spread of you touching that particular." [34]

From this letter it is evident that Doctor Fuller improved his opportunities and fully converted Governor Endicott from the prejudices and jealousies which he held concerning the Plymouth Settlement. It is worthy of note that Mrs. Endicott died during one of these visits of Doctor Fuller. Governor Winthrop's settlers shared the fate of all the other expeditions to the Colonies, and so great was the sickness among them at Charlestown that Doctor Fuller was requested to aid them in their distress, which he promptly did, rendering good assistance and earning the thanks of Governor Winthrop and his Colony.

In June, 1630, Doctor Fuller wrote: [35] "I have been to Matapan (now Dorchester) and let some twenty of those people blood." Again, in August, 1630, while at Charlestown he writes: [36] "There is come hither a ship (with cattle and more passengers) on Saturday last which brings this news out of England; that the plague is sore, both in the city and country, also there is like to be a good dearth in the land by reason of the dry season—the sad news here is that many are sick and many are dead—I here but lose time and long to be at home. I can do them no good, for I want drugs and things fitting to work with." In these letters we find positive proof that Doctor Fuller knew that the infectious nature of the disease called for other remedies than bleeding. Much surprise and confusion has been manifested by many writers over the fact that Doctor Fuller bled the sick people of that period, yet bleeding was a well authorized treatment for typhus fever during the seventeenth century,[37] a fact which strongly suggests the sickness prevailing.

Governor Endicott in his memoirs [38] says: "Such was the great mortality among them (Endicott's party) during this first winter after their arrival arising from the rigors of untried climate, and their being badly fit and badly lodged that there were scarcely found in the settlement well persons enough to nurse and console the sick—to enhance their distress they were destitute of any regular medical assistance."

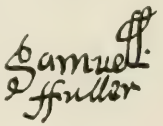
Doctor Fuller was a man of keen observation and good reasoning. In writing to Governor Bradford while he was yet among the people at Dorchester (1630) he says: "I have had conferences with them all till I was weary. The Governor (Endicott) is a goodly wise and humble gentleman and very discreet, and of a firm and good temper. We have some privy enemies in the bay but (blessed be God) more friends,—the Governor had conference with me, both in private and before sundrie others—the Governor told me he hoped we will not be wanting in helping them, so that I think you will be sent for." [39] The great influence which these visits of Doctor Fuller to the Endicott Settlement had upon the affairs of the early progress of this country has never been fully set forth. There had been much disappointment in England over the result of the enterprise sent out here. Those who had backed the venture financially had received little or no return. The meagre exports from this country had been seized. Enemies had circulated many discouraging rumors in England concerning the objects and doings of the planters in New England. Winslow, Allerton and Standish had made repeated trips to England for support, but with little success. The Indians were being incited to hostilities, and finally the arrival of the Endicott party who brought with them prejudices and unfriendliness towards the Plymouth settlers. After Fuller had gone among them on his visit of mercy and help, all this changed. Endicott sent back to England a report setting forth in most favorable terms the state of affairs here, as well as a glowing account of the climate, the country and its resources. The result was a changed sentiment in England, an increased confidence in the Plymouth settlers and the active co-operation at home of men of wealth and position with a greater disposition towards emigration to this country, and consequently a rapid, vigorous growth of many new colonies which meant the complete success and permanency of the settlement in the new world. His successors in the healing art, if none others, might well provide a suitable memorial of this good physician's visits of mercy to the pestilent-stricken settlers of infant Salem, Dorchester and Boston.

In the epidemic of smallpox which prevailed in 1633 many fell very sick, and about twenty died, men, women and children, including many of the old settlers from Holland, among whom was Samuel Fuller (after he had much helped others) and "had been a great help and comforte unto them; as in his faculties, so otherwise, being a deacon in ye church, a man godly, and forward to doe good, being much missed after his death; and he and ye rest of their brethren much lemented by them, and caused much sadness & mourning amongst them." [40] This disease was also very fatal among the Indians from all the adjoining places. A curious fact in relation to this epidemic was that it had been prophesied by the Indians in May on account of the great quantities of a sort of fly, about the size of wasps or bumble bees, which came out of holes in the ground, and filled the woods, eating the green things and making a constant yelling noise, deafening to hear. These insects (locusts?) were unknown to the English. The epidemic followed in June, July and August

during the heat of summer. Notwithstanding the many trials, hardships and toils to which a physician is subjected even in these days of conveniences and luxuries, it is both gratifying and significant to find this early physician acting as the guardian of the future welfare of the community by perpetuating learning among its children. In his will he mentions four youths entrusted to his care who were to be returned to their parents at Charlestown and Dorchester. This will, both on account of the fact that it is the first will probated in this country as well as the many points mentioned therein touching the life, work and character of Doctor Fuller is here abstracted as follows: "

"I Samuel Fuller the Elder being sick & weake, but by the mercie of God in pfect memory ordaine this my last will and testmt. I doe bequeath the Education of my children to my Brother Will Wright & his wife, onely that my daughter Mercy be & remaine to good-wife Wallen so long as she will keepe her at a reasonable charge. But if it shall please God to recover my wife out of her weake state of sickness then my children to be with her or disposed by her. I desire my Brother Wright may have the bringing up of a childe comitted to my charge, called Sarah Converse, but if he refuse then I comend her to my loving neighbor and brother in Christ Thomas Prince.

"Item. Whereas Eliz. Cowles was submitted to my educacion by her father and mother still living at Charlestowne, my will is that she conveniently appelled & returne to her ffather or mother. And for George ffoster being placed wth me by his parents still living at Sagos, my will is that he be restored to his mother. Item. I give to my son Samuel my house and land at the Smelt river; I order certain portions of my estate (naming them) to be sold to educate my two children Samuel & Mercy. I give land adjoining Mr. Isaac Allerton's to my son Samuel and also land on Strawbury hill given to me by Edward Bircher, if Mr. Roger Williams refuse to accept it as he has formerly done. Item. My will is that my cozen Samuel, goe away with his stock of cattle and swine without any further recconing. Item. My Estates, and cattle with my two servants Thomas Symons & Rob't Cowles be employed for the good of my two children, by my Brother Wright and Priscilla his wife. I give to the church of God at Plymouth the first cow calfe that my brown cow shall have. I give to my sister Alice Bradford twelve shillings to buy her a pair of gloves. Whatever is due to me from Capt. Standish I give unto his children. Item. That a paire of gloves of 5sh be bestowed on Mr. Jno. Winthrop Gov. of the Massachusetts. Item. Whereas Capt. John Endicott oweth me two pounds of Beaver, I give it to his sonne. It. My will is that my children be ruled by my overseers in marriage. It. I give unto John, Jenny & Joh. Winslow each of them a pair of gloves of five shillings. It. I give unto Mr. Heeke, the full sum of twenty shillings. I give unto Mr. William Brewster my best hat and band wch I never wore. I give to Rebecca Prince 2 sch 6d to buy her a pair of gloves. My will is that in case my son Samuel die before he come into inheritance of my estate then they are to go to my kinsman Samuel Fuller now in the house with me. I appoint my son Samuel my executor, and Mr. Edward Winslow, Mr. William Bradford & Mr. Thomas Prince my overseers. To my daughter Mercy one Bible with a black cover. It. Whatsoever Mr. Roger Williams is indebted to me upon my booke for physick I fuly give him."



Fac-Simile Autograph. Very rare.

"Memoranda—Whereas the widow Ring submitted to me the oversight of her sonne Andrew my will is that Mr. Price take charge of him."

The widow of Samuel Fuller and her son Samuel joined in a gift (1644) to the church of Plymouth for the use of a minister the land (half an acre) once owned and occupied by Doctor Fuller, and upon which the parsonage house of Harvey W. Weston now stands.[42] Mrs. Fuller is mentioned as one of the earliest women practitioners of midwifery in this country. The town records of Rehoboth, Massachusetts, July 3, 1663, says, "Voted, and agreed that—Mrs. Bridget Fuller of Plymouth should be sent to, to see if she be willing to come and dwell among us to attend on the office of midwife, to answer the town's necessity, which at present is great." This invitation was not accepted, as she died at Plymouth the next year.[43] Her son Samuel was offered the call to the church at Rehoboth at the same time. The son Samuel became a clergyman and was the first minister of the church at Middleboro, Massachusetts. He married a granddaughter of Elder Brewster.[44] His daughter Mercy married Ralp James.

On the death of Doctor Fuller an early writer[45] says: "In his medical character, and for his christian virtues and unfeigned piety Dr. Fuller was held in the highest estimation, and was resorted to as a father and wise counselor during the perils of his day. He was finally one of the several heads of families who died of a fever which prevailed in Plymouth in the summer of 1633, and was most deeply lamented by all the colonists."

Doctor Fuller's library contained only twenty-seven books, among which are mentioned two dictionaries and "Peter Martyr on Rome." It is safe to suppose that the well-stocked libraries of Brewster, Winslow and Bradford were freely open to the use of Doctor Fuller. Although medical literature must have been very scarce in those days, the physical endurance required for a day's labor was hardly calculated to encourage much leisure reading. Meagre as were the literary advantages of the early colonists, one of the most prominent characteristics of the people was the solicitude for the education of the children. New England's first fruits published in London in 1643 says: "One of the next things we longed for, and looked after, was to advance learning and perpetuate it to Posterity."[46] It is to this spirit that the founding of Harvard College at such an early period (1638) can be ascribed, a movement in which Samuel Fuller must have been an early and important factor. In this connection it may be said that the influence which Doctor Fuller had exercised for the cause of education was continued by his good wife, and the

first court record which alludes to schools in this country says that it was ordered by the court in 1635 "that Benjamine Eaton (a lad 8 years old) with his mother's consent, is put to Bridget Fuller, being to keep him at school for two years, and employ him after in such service as she saw fit, and he shall be fit for." [47] Modernity is apt to lay claim to all that is good and noble in the many walks of life, forgetful of the many hardships, sacrifices and trials which have been endured and overcome in its completion. Let us hope that the one profession above all others whose whole life is one of self-sacrifice and charity will not be unmindful of the good work of its pioneers.

History affords fewer examples more worthy of honoring or more creditably representing the self-sacrificing, broad-minded, truly charitable Christian physician than the life practiced by Doctor Samuel Fuller among the first settlers in this country. How fittingly apply the words of the Master, "Greater love hath no man than this, that a man lay down his life for his friends."

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THE RELATION OF THE STATUS LYMPHATICUS TO SUDDEN DEATH, DEATH UNDER ANÆSTHESIA, AND INFECTION.

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Introduction.

There is probably no form of sudden death which has received so much attention from the medical profession in recent years as that form associated with the hyperplasia of the thymus gland and the lymphatic apparatus in general, known as the "status lymphaticus." At the same time that discussion regarding *spontaneous* sudden death in this condition has been going on, a few articles have called attention to the similarity which exists between the lesions of this form of spontaneous sudden death, and many cases of death under anæsthesia, and an occasional article also has suggested

a relationship between sudden death during infectious diseases and the status lymphaticus.

All three classes of cases are of interest to the physician both from a purely professional and from a medico-legal point of view. From a professional standpoint it is of the greatest importance that we should recognize the existence of a class of individuals, the subjects of a peculiar constitution which renders them extremely susceptible to shocks of various kinds, physical, psychical, and toxic, and which may lead to their sudden death from accidents which to the ordinary individual would be trivial. In considering this aspect of these cases we need only recall the instances where death has followed some trivial shock, or as trifling an operation as the hypodermic administration of a standard remedial agent. Instances are on record where individuals who were subjects of this constitution have died from the shock of a plunge into cold water, and the case of Prof. Langerhans' child, who died a few minutes after the administration of antitoxine, is familiar to many medical men. The medico-legal aspect of these cases bears mainly upon sudden death in apparently healthy infants where a suspicion of foul play is entertained. A number of cases are on record where nurse maids, or relatives, have been accused of suffocating or fatally maltreating infants, the true cause of death being shown by the autopsy to be the status lymphaticus.

Aside from the relation of the status lymphaticus to the class of cases above enumerated, certain authors have called attention to its rather frequent coexistence with other diseases, notably with rachitis, epilepsy, and exophthalmic goitre. It is not the purpose of this paper to discuss the relationship between these conditions and the status lymphaticus further than to state that *such a relationship is by no means constant.* While we admit the relatively frequent association, and even believe that the status lymphaticus may modify the course of these diseases when associated with them, we can see no evidence which proves that these diseases are dependent on changes in the thymus or lymphatic apparatus, and we regard the coexistence as merely a coincidence.

The object of this paper, as expressed by its title, is to endeavor to show the common factor which underlies cases of sudden death associated with the "status lymphaticus" whether these occur spontaneously, or under the influence of a chemical (anæsthesia) or bacterial (infection) poison. We might add that we deem it probable that the same common factor underlies cases of epilepsy or exophthalmic goitre associated with the status lymphaticus, but this is merely an assumption on our part, as we have had no personal experience with such cases.

The views which are here set forth are based upon the study of nine cases of sudden death occurring in infancy and childhood, and upon the study of the available literature. We would point out in passing that, in our opinion, the great weakness of most of the articles on the subject lies in the almost total failure to consider the histology and bacteriology of the condition, subjects which are briefly touched on in some reports, and which we aim to treat more fully. Inasmuch as the pathological anatomy and histology are essentially the same in all classes of cases we shall consider the clinical features first, next discuss the pathology, and finally consider the theories regarding the import and significance of the status lymphaticus.

Clinical Considerations.

Spontaneous sudden death associated with the status lymphaticus.

General Considerations.—The association of sudden death with enlargement of the thymus was noted as long ago as 1723 by Bichat, but the subject was not brought into prominence until 1829, when Kopp emphasized it, and also drew attention to the so-called thymic asthma. Friedleben's monograph in 1858 threw doubt upon the relation of enlarged thymus to sudden death, and the subject remained quiescent until 1888, when the work of Grawitz in Germany and Jacobi in this country revived it. The recognition of the fact that the enlarged thymus is merely part of a general hyperplasia of the lymphatic apparatus we owe to the Vienna school, and particularly to Paltauf. In some cases, and particularly in adults, the lymphatic hyperplasia is associated with a hypoplasia of the heart and aorta, similar to that described by Virchow in chlorotic subjects, so that in connection with these cases Paltauf speaks of the chlorolymphatic constitution.

Before describing the various clinical pictures which immediately precede the death of these patients, it may be well to consider whether it is possible to make a diagnosis of the status lymphaticus before the onset of the attack which is the immediate cause of death. Certain clinicians, and particularly those of the Vienna school, believe that individuals who are the subjects of the lymphatic constitution can in many cases be recognized. Escherich, who has studied these cases carefully, states that they usually have a pale, thin skin, a pasty complexion, and a good pad of subcutaneous fat. Frequently signs of rachitis or scrofula are present. The superficial lymph glands, especially those of the neck and axilla, are enlarged. There is hypertrophy of the tonsils, the circumvallate papillæ of the tongue, and the pharyngeal lymphatic apparatus (adenoids). The spleen is often palpable. Daut adds that a percussable thymus may develop later, and Ewing's work strongly suggests that an increase in the lymphocytes of the blood is in all likelihood present.

Unfortunately up to the present time our knowledge of the clinical symptoms of these cases relates mainly to the appearances observed immediately or shortly before the death of the patient, and this is almost of necessity the case, inasmuch as the majority of these patients are apparently in perfect health up to within a short time of the fatal issue. The clinical picture varies in different cases, and we shall attempt to classify the cases according to the clinical features, though the immediate causes of death are probably only two, cardiac paralysis and asphyxia.

Cases found dead in bed.—A number of our cases, and of the cases in the literature, come under this heading. This type of death usually occurs in young infants, and most of the cases in which foul play has been suspected are of this nature. It is a question whether many of the cases of "overlying" of infants would not be found to be instances of death from status lymphaticus if investigated. The manner of death in these cases is of necessity uncertain; at the same time there are grounds for believing that the infants are not perfectly well for a short time, perhaps some hours, before death, and probably death takes place in a convulsive seizure. In some of our cases of this character, which occurred in St. Margaret's House under Dr. H. L. K. Shaw, the records show that the children refused food sometimes as long as an hour before they were found dead, which is presumable evidence that they did not feel well. A death in convulsions is also suggested by the history of some of these cases, of which the following case, which occurred in the practice of Dr. G. Emory Lochner, is an example.

The mother of an apparently healthy female child, ten months of age, was in the habit of putting her to sleep in a baby carriage on the veranda while she attended to her household duties. On March 16, 1903, she followed her usual custom. Whilst working near an open window in the neighborhood of the baby carriage she heard the child move, and looking out at her saw her struggling. Thinking that she was merely struggling in her sleep she avoided going very close to her, but on returning and looking at the child a few minutes later she found her head.

Cases of sudden death presumably of cardiac origin.—Under this head we may reasonably place cases where the death was very sudden and not preceded by respiratory disturbances. In all probability cases reported by Nordmann and others, where sudden immersion in cold water was followed by instant death, belong to this class. It is questionable whether some of the cases found dead in bed should not also come under this heading.

Cases of sudden death, presumably of respiratory origin.—Most of the cases of sudden death in status lymphaticus with symptoms of respiratory difficulty may be classed under the general heading of thymic asthma. There is no doubt that this condition has been confounded by some observers with ordinary laryngismus stridulus, but the majority of clinicians who have studied the two conditions in recent years agree that there is no relation between the two diseases. Lange states that the paroxysm in thymic asthma differs from that in laryngismus stridulus in that regular sighing respiration is present throughout the attack in the former condition. The history of one of our cases tends to show that this is not necessarily so. The cases of thymic asthma do not all present the same clinical picture; in some instances the child dies in the first attack or series of attacks, whilst in other cases the condition may last for a week or even years and finally terminate in a fatal attack or relief by operation. The operative procedures thus far resorted to in these cases have been total extirpation of the gland or partial extirpation and pulling upward of the gland, the portion left being anchored to the sternum high up. The following case, which occurred in the service of Dr. W. H. Happel in the Albany Hospital, well illustrates the form of thymic asthma which is rapidly fatal. I quote from Dr. Happel's history:

A male child, apparently healthy and weighing 6½ pounds at birth, continued to gain weight up to the 14th day of his life. On the morning of the 14th day it was noted that he had made no gain in weight but seemed otherwise well. At 4 p. m. he was found cyanosed at his mother's breast. He was unconscious, with crowing inspiration. The reflexes were abolished. The pulse was slow and gradually became slower. The inspiration became quicker and shorter, and then both pulse and respiration ceased. The child became rigid, cyanotic and pale. The thorax was arrested during inspiration. The child became limp. After about thirty seconds a loud inspiratory shriek ushered in the respiration and the heart beats completing a marked attack of laryngismus stridulus. The attacks were repeated several times, the child never becoming conscious in the intervals. Death occurred seven hours after the onset of the first attack. From the presence of a percussable dullness over the manubrium Dr. Happel made a diagnosis of thymic hyperplasia with status lymphaticus, which was confirmed at autopsy.

These cases in which the child dies during an acute attack after a few hours, or even in the first attack, are much more common than the cases running a more protracted course. We cite the clinical history of a chronic case from Purrucker:

An otherwise healthy child, 2½ years of age, with no signs of rickets, and no palpable glandular enlargements, had suffered from difficulty in breathing since the age of two weeks. There was a gradually increasing inspiratory dyspnœa with sudden attacks of greater severity, and the parents feared sudden death from asphyxia. When the child was quiet it breathed slowly and noisily. The noise was louder on lying down than when the child was sitting up. There was no cyanosis. Psychic disturbances increased the dyspnœa. Purrucker describes the clinical picture as being typical of the stridor of infants. Operation was finally decided on and an enlarged thymus was removed without difficulty, the child making a prompt and satisfactory recovery and the symptoms disappearing.

Some cases of death in status lymphaticus die with signs of suffocation and without definite asthmatic seizures. Such cases are described by Gerhardt and also by Somma. The child presents accelerated respiration, an access of suffocation, cyanosis, dilatation of the pupils, swelling of the veins in the neck, and death occurs in a few minutes.

Cases of sudden death, presumably of nervous origin.—The occasional association of the status lymphaticus with epilepsy has already been briefly referred to. Ohlmacher has called attention to the resemblance between the attacks in the two conditions. While we have no cases to report of this association of conditions, we would point out that the manner of death in some of the reported cases of status lymphaticus resembles the type of death associated with lesions of the central nervous system rather than that due primarily to

cardiac or respiratory failure. Some of the cases reported have died very suddenly during a spasm which by some writers has been described as epileptiform.

Laub has described cases of what he calls the cerebral form of death from status lymphaticus. This form differs from the ordinary form in several particulars. It usually occurs in young adults and causes death in a few hours, eighteen at the outside. The individual is attacked suddenly with coma or perhaps epileptiform convulsions. Sometimes cramp of the glottis occurs, or vomiting of a cerebral type. The urine usually contains albumen but no casts. The post-mortem picture is the ordinary one of the status lymphaticus plus cerebral œdema. Laub considers that these cases differ from the ordinary ones in their slower development, this allowing time enough for the occurrence of cerebral œdema and the resulting nervous phenomena.

The Relation of the Status Lymphaticus to Death During Anæsthesia.

Within the last few years attention has been called to the relation of the status lymphaticus to deaths during or soon after the administration of an anæsthetic. In Europe, Bayer, v. Kundrat and Ploc have especially noted this phase of the subject, and in this country Hinkel, and more recently Blake have emphasized it. Almost all observers agree that in these cases death is due to *cardiac* failure, and most of the case histories show plainly that respiration persists after the heart has stopped beating. In some cases premonitory symptoms in the form of pallor, dilation of the pupils, weakening of the pulse and shallow respiration are observed, but in many instances death is instantaneous. It was thought by the earlier writers that chloroform was especially dangerous as an anæsthetic in these cases, but in recent years it has been shown that deaths have also occurred under ether, and the A. C. E. mixture of Billroth. The fact that chloroform was at first regarded as unusually dangerous was no doubt due to the fact that the earlier cases were reported from Europe, where this anæsthetic is largely used. Blake's cases show plainly that ether is also dangerous. The reported deaths under anæsthesia have occurred at all ages, and bear no particular relation to sex as far as can be judged. When we come to consider whether deaths from anæsthesia associated with the status lymphaticus bear a relation to any particular disease or diseases it would seem as though two classes of patients are especially liable to this accident, patients with goitre, either simple or exophthalmic, and patients with adenoid vegetations.

The Relation of the Status Lymphaticus to Infection.

There is very little in the literature bearing directly on this phase of the subject. Paltauf suggests that the real cause of death in some of the cases supposed to have died in status lymphaticus was capillary bronchitis, but our cases, which were controlled by histological and bacteriological examinations, do not support this view. Daut has published an interesting series of cases from Escherich's clinic, in which he discusses the effect of the status lymphaticus on diphtheria. He found that over a quarter of the patients dying from diphtheria presented the picture of the status lymphaticus. Distinct modifications of the clinical picture of the disease were present in these cases. In some instances the patients had a hoarse barking cough and a hoarse voice, associated with attacks of spasmodic suffocation, weakness of the heart, and rapidity of the pulse. These attacks were altogether out of proportion to the severity of the membrane formation as shown post mortem. In other cases the patient died suddenly, having shown no unusual symptoms during life referable to the status lymphaticus. In this connection we give the clinical histories of two of our cases which show that the status lymphaticus may mask or modify other infections.

(1) *Tetanus modified by the status lymphaticus.*—The patient was a case of Dr. W. O. Stillman.

The patient, a boy of 12 years, accidently wounded himself on the inside of one of the fingers of the right hand while discharging a toy pistol July 3, 1900. The wound was a very slight one and attracted but little attention. It was treated with ordinary home remedies and appeared to be doing fairly well, although there was a very slight discharge from it. The patient remained in good health until Friday, July 6, when he complained of headache, chilliness, general malaise and sore throat. He was seen on Friday evening by a physician who administered some palliative remedies. The patient had a very restless night Friday night, complained of most intense headache, pain in the back of his neck, as well as general aching through the muscles of the back, arms and legs. The temperature on Friday was somewhat elevated, between F. 100° and 101°. On Saturday morning the patient appeared to be somewhat worse, the temperature was in the vicinity of F. 101°, the throat was quite sore and the tonsils decidedly swollen. The headache and other pains were about the same. The case was regarded as one of tonsilitis and treated as such. The patient's symptoms became somewhat worse during the day on Saturday and he passed an extremely restless and uncomfortable night Saturday night. Saturday afternoon he complained of some difficulty in opening the mouth, which at the time was attributed to the swollen tonsils. This difficulty became worse during the night, and Sunday forenoon, about 10 o'clock, all of the patient's symptoms having become decidedly worse, he was suddenly seized with opisthotonos, and died in a few minutes.

The autopsy was done on the morning of the following day, Monday, by Dr. Elting and showed the usual lesions of the status lymphaticus, and cover-slips from the wound of the finger showed large numbers of typical drum-stick tetanus bacilli.

(2) *Streptococcus infection modified by the status lymphaticus.*

The patient was a boy of 13 years of age with a history of never having been strong, and of showing dyspnœa on exertion since childhood. There was no history of epilepsy. He was an inmate of an orphan asylum, and apparently in his usual health until within a short time of his death. On the day of his death he suddenly became cyanotic a short time after his evening meal, had one or two convulsions and died in fifteen minutes.

The autopsy showed the usual picture of the status lymphaticus with acute bronchitis and congestion of the lung. Cultures showed a general streptococcus infection.

It would seem from Daut's experience and the cases just reported that the status lymphaticus may have a distinct influence on infections, sometimes modifying their course, and sometimes masking them. Daut's experience with diphtheria shows a distinct modification of the ordinary clinical picture in some cases, and in the two cases reported by us the tetanus case showed an unusually acute course, and the case of streptococcus infection was completely masked up to the time of the patient's death.

The Pathological Anatomy of the Status Lymphaticus.

There is a general agreement among pathologists as to the gross lesions associated with the status lymphaticus. These consist, broadly speaking, of a hyperplasia of the thymus gland, and of the lymphatic tissue of the body in general. It is necessary to state, however, that the degree of hyperplasia, and also the extent of it, varies in different cases. In practically all cases the thymus is hyperplastic, but in some cases only one or two groups of glands may be affected, in others the intestinal or the splenic lymphatic apparatus may be especially involved, and in still others there may be a widespread hyperplasia of all the lymphatic tissues of the body.

Aside from these lesions of the lymphatic apparatus, which are constant, we find other lesions present with a fair degree of constancy. Hypoplasia of the vascular system, first pointed out by Paltauf, has been described more frequently in adults and children nearing puberty than in infants. In some cases compression of the trachea by the enlarged thymus has been noted, and in instances of this kind the accompaniments of asphyxia may be present in the form of subpleural and other subserous hemorrhages, and atelectatic patches in the lungs. Œdema and congestion of the lungs have also been noted in some cases. Œdema of the brain has been described by Laub. Some observers have described a lymphoid condition of the bone-marrow, and occasionally an enlarged thyroid gland has been noted.

The Histology of the Lymphatic Apparatus and Thymus in Status Lymphaticus.

The close histological study of these cases has been strangely neglected. Paltauf, and later Ewing, speak of the lesions as a simple hyperplasia. Lartigau in Blake's paper describes lesions in the spleen which he compares to the lesions found in diphtheria and other infections. The lesions which we found were constant and identical in all of the nine cases examined, though differing in degree. Briefly stated they were as follows: In the thymus gland there was a general hyperplasia of the lymphoid elements, associated at times with proliferation of the endothelial cells lying along the trabeculæ of the organ. In the lymph nodes, Malpighian corpuscles of the spleen, the tonsils, and the lymphatic apparatus of the intestine there was a general hyperplasia associated with focal changes. These focal changes occurred in the lymphatic apparatus in connection with the germinal centers, and in the spleen in the Malpighian corpuscles. The lesion in the lymph nodes, tonsils, and intestinal apparatus consisted of a proliferation of the cells composing the germinal centers, associated with slight degenerative changes in the proliferated cells. In the spleen a similar proliferative process was to be noted in the Malpighian corpuscles associated in places with a decided proliferation of the endothelial cells of the vessels of these bodies. The lesions very closely resemble those seen in various infections, and differ we believe only in degree, degenerative changes being much more marked in case of bacterial infection.

The Bacteriology of the Status Lymphaticus.

Very few statements are found in the literature regarding this point, which in view of the histological findings is a very important one. Lartigau's report in Blake's article indicates that cultures were negative in this series of cases. In our cases cultures, and in some cases cover-slips, were made, and it was found that outside of the cases definitely stated to be infected, the cultures were sterile. It is true that pus cocci were occasionally found in the lungs, and that the ubiquitous colon bacillus was also present in some cases, but we do not consider either of these findings evidence of infection; they are rather instances of agonic or post-mortem invasion. Some other factor than bacterial infection therefore must be held responsible for the lesions in most cases of the status lymphaticus.

The Causes of Death in the Status Lymphaticus.

A variety of explanations have been advanced from time to time to account for sudden death in the status lymphaticus. These explanations naturally fall under one of two heads: theories assuming that death is due to mechanical pressure of the enlarged thymus upon structures of vital importance, and theories assuming that death is due directly to cardiac paralysis, and indirectly to some form of toxæmia. We shall consider both groups of theories and their various subdivisions more or less in extenso.

The most important of the mechanical theories assumes that death is due to asphyxia from compression of the trachea by the enlarged thymus gland. This theory has developed a great deal of opposition, doubtless because many observers have never seen cases in which there was evidence of compression of the trachea. This, in fact, has been our experience, for in only one of our nine cases was there any evidence of tracheal compression, and in this case the compression was only partial and not sufficient to interfere with respiration. The supporters of the tracheal compression theory point out the very narrow space in children between the manubrium and the spinal column (2 cm.), and the fact that throwing back the head greatly increases the pressure on the trachea. The opponents of this theory emphasize the great difference between the weight of the enlarged thymus and the compressibility of the trachea. The thymus in very

few of these cases exceeds fifty grammes in weight, and according to Tamassia it takes a pressure of one hundred and eighty grammes to compress the trachea; according to Scheele seven hundred and fifty to one thousand grammes weight is needed. It seems reasonable to believe that these opposing views are largely due to diverse individual experiences, for although many of the cases show no evidence of tracheal compression, in others the evidence is very convincing. Such writers as Grawitz, Clessin and Lange have published cases in which the evidence of compression seems incontrovertible.

Other writers suggest the possibility of death being due to compression of structures other than the trachea, as the heart itself, the large vessels, or the large nerves or nerve plexuses. It is supposed that pressure on the heart might interfere with its action, and in one or two reported cases the auricles are stated to have been atrophic. The advocates of the theory that pressure on the large vessels may cause death assume that such pressure may cause a fatal anæmia of the brain. Pressure on the nerves (pneumogastric, phrenic) or nerve plexuses (cardiac, respiratory, might cause death either reflexly or by direct paralysis of the heart or lungs. With regard to all these theories we may simply state that there is practically no anatomical support for any of them, and they therefore belong in the domain of pure hypothesis.

The theory that the cause of death in the status lymphaticus may be a toxæmia was voiced by Escherich when he compared this condition with myxœdema and exophthalmic goitre. This view would assume that the process was due to an over-production of the internal secretion of the thymus. Inasmuch as the evidence in favor of the possession of an internal secretion by the thymus is contradictory in the extreme, and taking into account the histological structure of the organ, we feel somewhat skeptical as to the existence of a true internal secretion from this gland, and would suggest that it is in all probability merely a lymphatic organ. It is true that it possesses epithelial elements in the form of Hassal's corpuscles, but hardly anybody, as far as we know, has ever claimed that they are anything more than rests explicable by the mode of origin of the gland. In Blake's article Lartigau suggests a toxic origin for these cases from a study of the histological lesions, but does not state definitely what he considers the nature of the toxine to be. In connection with the toxic theory we wish to call attention to the great similarity which exists between the lesions of the status lymphaticus and the lesions described by Flexner in his paper on lymphotoxæmia. We quote from Flexner his description of the lesions produced in the guinea-pig by lymphotoxins.

"The changes in the lymph glands are diffuse, affecting the cortical nodes and the medullary strands of lymphatic tissue. The most striking alteration is found in the germinal centers and consists of increased swelling, and, to a small extent degeneration of the large cells composing these areas. The enlargement of the centers is accompanied by a general lymphoid cell hyperplasia. Mitoses in the clear cells occur but some of the figures undergo subsequent degeneration. The chief form of cellular degeneration is that attended by vacuolization and fragmentation of the nuclei; pyknosis is also encountered.

Spleen.—The changes in the spleen appear to be limited to the Malpighian bodies, in which the germinal areas are increased in size; mitosis is actively progressing, and nuclear degenerations while met with, occur less frequently than in the lymph glands."

We would therefore advance the hypothesis that the condition which is present in the status lymphaticus is one of lymphotoxæmia. It is not necessary to assume, we think, that the toxæmia is constantly present; in fact the clinical pictures are more readily explained by the assumption that it is intermittent. In order to accept such an explanation it is of course necessary to assume that at times the so-called "horror autotoxicus" is in abeyance, and we can see no theoretical reason why this should not be the case. In this connection we quote from Dr. Welch's Huxley lecture. In speaking of cytotoxins he says:

But the really great practical questions in this domain relate to the production of autocytotoxins in the human and animal body. What is the nature of that very efficient regulatory mechanism underlying the horror autotoxicus which prevents either the action or the formation of autocytotoxins in consequence of absorption of our own degenerated and dead cells? Can this protective mechanism be overthrown by pathological states and self-generated cellular poisons become operative in the causation of anæmias, hæmoglobinurias, chronic interstitial inflammations, uræmia, eclampsia, epilepsy, and other diseases?

We would suggest that individuals who are subjects of the status lymphaticus are born with an instability of the mechanism regulating the "horror autotoxicus" at any rate so far as the lymphatic apparatus is concerned, so that they are subject to intermittent attacks of lymphotoxæmia which may lead to reflex nervous phenomena of various kinds, or may cause death from cardiac paralysis. During the attacks of lymphotoxæmia such individuals are especially susceptible to the action of bacterial or chemical poisons, and also to physical and psychical shocks, which at these times may cause their death under circumstances which would be trivial to a normal individual. Assuming the possibility of this hypothesis it would seem from experimental evidence that a so-called vicious circle might be established. Flexner's experiments show that the lymphocytotoxins cause a hyperplasia of the lymphatic apparatus, and succeeding mild attacks might therefore cause a progressive hyperplasia of the lymphatic apparatus, increasing the amount of lymphoid tissue which might take part in subsequent attacks of lymphotoxæmia.

Conclusions.

1. The condition known as the status lymphaticus is a definite pathological entity.

2. It is probably associated with, if not due to, a condition of intermittent lymphotoxæmia.

3. It may be associated with sudden death, probably as a result of lymphotoxæmia alone in some cases, or as a result of the action of toxic, physical, or psychic injuries, which are

rendered much more powerful than usual by the predisposing action of the lymphotoxæmia.

4. In some cases the sudden death is undoubtedly mechanical and due to asphyxia from pressure of the enlarged thymus on the trachea.

5. The subjects of the status lymphaticus can be recognized clinically in some instances.

Bibliography.

References to the more important articles dealing with the subject may be found in the following papers:

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References on Sudden Death in the Index Catalogue of the Surgeon General's Library. Second Series, Vol. IV.

Appendix.

Abstracts of the histories of the nine cases on which this study is founded, together with the abstracts of the autopsy protocols and histological examinations are here appended. We desire here to express our thanks to the following gentlemen who have kindly furnished us with the clinical histories of the cases: Drs. W. H. Happel, G. E. Lochner, W. G. MacDonald, H. L. K. Shaw, W. O. Stillman, T. M. Trego and Howard Van Rensselaer.

Group 1.—Cases dying suddenly or found dead in bed.

Case 1.—Female child, five months of age, St. Margaret's House, Service of Dr. Van Rensselaer. The child was apparently perfectly healthy until a few minutes before its death (February 10, 1899), when it suddenly became cyanosed and collapsed.

The *anatomical diagnosis* was: Enlargement of the thymus gland and the mesenteric lymph nodes. Cloudy swelling of the liver and kidneys.

The following notes regarding the pathological changes are extracted from the autopsy protocol:

Thymus Gland.—Is much enlarged, reaching to the base of the heart. It measures 5 x 3 cm. x 8 mm. On section it presents a normal appearance.

The mesenteric glands are enlarged, the largest of them measuring about 5 mm. in diameter. Some are firm and pale, others congested.

Intestines.—The mucous membrane is pale. In the ileum the Peyer's patches and solitary follicles are somewhat enlarged. The enlargement of the lymphatic apparatus is slight. The solitary follicles in the large intestine are slightly enlarged.

The spleen measures 4 x 3 x 1.5 cm. The surface is smooth. The consistency quite firm. On section the pulp is not increased, the trabeculæ are prominent, the Malpighian bodies are not visible.

The remaining organs showed nothing of importance.

Cultures were negative except that a few isolated colonies of the staphylococcus aureus were isolated from the lung.

Microscopic:

Thymus Gland.—Hyperplasia of the lymphoid elements is present. There is some proliferation of the endothelial cells lying along the trabeculæ. Degenerative changes in Hassal's corpuscles are marked.

Lymph Glands.—There is hyperplasia of the lymphoid structure and increased size of the germinal centers with swelling and proliferation of their constituent cells. There is swelling of the endothelial cells along the trabeculæ.

Spleen.—There is a slight general increase in the finer trabeculæ. Dilatation of the blood spaces is present with increase in the phagocytic cells of the organ. There are marked changes in the Malpighian corpuscles in the form of great proliferation of cells similar to those seen in the germinal centers of the lymph glands. A slight amount of degeneration of the proliferated cells is present.

The other organs aside from cloudy swelling of the liver and kidneys are normal.

Case 2.—Male child, 3 months of age. St. Margaret's House. Service of Dr. T. M. Trego. The child, who was apparently healthy, was found dead in bed. The autopsy was made twelve hours after death.

The *anatomical diagnosis* was: Enlargement of the thymus gland. General lymphatism. Cloudy swelling of the liver and kidneys. Slight congestion of the right lung.

The following notes are abstracted from the autopsy protocol:

Thymus Gland.—Is much enlarged. It extends from the episternal notch downward and covers the upper half of the precordia. It is pale and cloudy looking on section. It contains no hemorrhages. It measures 7 x 6 x 1.5 cm.

Mesenteric lymph nodes are considerably enlarged, soft, and on section pale gray in color.

Intestines.—The mucous membrane of the small intestine is pale. In the large intestine the solitary follicles are enlarged.

The Spleen.—Is free from adhesions. Measures 6.5 x 4 x 2.5 cm. The capsule is smooth, the consistency about normal. On section the pulp is not increased, the Malpighian bodies are prominent.

The remaining organs showed nothing beyond the lesions mentioned in the anatomical diagnosis.

Cultures were negative.

Microscopic:

Thymus.—Marked hyperplasia of the lymphoid tissue is present.

Lymph Glands.—The germinal centers are prominent and show proliferation of their constituent cells with some swelling of the proliferated cells and slight degenerative changes. The gland tissue is hyperplastic.

Intestine.—Changes in the lymphatic apparatus, similar to those described in lymph glands, are present.

Spleen.—There is proliferation of the cells in some of the Malpighian bodies similar to those seen in the germinal centers of the lymph gland.

Case 3.—Male child, aged 18 days. Albany Hospital. Service of Dr. W. H. Happel.

A male child, apparently healthy and weighing 6½ pounds at birth, continued to gain weight up to the 14th day of his life. On the morning of the 14th it was noted that he had made no gain in weight but seemed otherwise well. At 4 p. m. he was found cyanosed at his mother's breast. He was unconscious, with crowing inspiration. The reflexes were abolished. The pulse was slow and gradually became slower. The respiration became quicker and shorter, and then both pulse and respiration ceased. The child became rigid, cyanotic and pale. The thorax was arrested during inspiration. The child became limp. After about thirty seconds a loud inspiratory shriek ushered in the respiration and the heart beats completing a marked attack of laryngismus stridulus. The attacks were repeated several times, the child never becoming conscious in the intervals. Death occurred seven hours after the onset of the first attack. The autopsy was performed 7 hours after death.

The *anatomical diagnosis* was: Enlarged thymus gland. Pulmonary œdema. Cloudy swelling of the liver with angiomata.

The following notes are abstracted from the autopsy protocol:

The thymus gland is much enlarged, measuring 5.5 x 4 x 2 cm. It extends well into the left pleural cavity reaching to the lower border of the third rib; it is composed of two distinct lobules. The capsule and gland are normal on section. The larynx and trachea show no evidences of compression.

The *lymph glands* posterior to the œsophagus are moderately enlarged.

The Intestines.—The mucous membrane shows patchy congestion. The follicles of the large intestine are enlarged.

The Spleen.—Measures 5.5 x 3.5 x 1.5 cm. The capsule is smooth, the consistency is normal. On section the Malpighian bodies are visible, and slightly enlarged.

Both lungs show a moderate amount of œdema.

The remaining organs are free from changes except those noted in the protocol.

Cultures showed the presence of a few colonies of the pneumococcus in the lung. The other organs were sterile.

Microscopic:

Thymus.—There is well-marked hyperplasia of the lymphoid tissue. Some endothelial proliferation along the trabeculæ is noted. Degenerative changes in Hassal's corpuscles are present.

Intestines.—There is hyperplasia of the lymphatic apparatus with proliferative changes in the cells of the germinal centers.

Spleen.—There is hyperplasia of lymphatic apparatus. Proliferation of the cells in the Malpighian bodies like that described in the other cases is present.

Lung.—Moderate œdema and congestion are present.

Case 4.—Illegitimate female infant, 5 months of age. St. Margaret's House. Service of Dr. H. L. K. Shaw.

She was found dead in bed by the nurse. She had lost weight since her entrance on Nov. 12, 1900. On the night of her death she slept well until 4 a. m.; at 5 a. m. she refused her nourishment, and she was found dead at 5.30 a. m. Autopsy 10½ hours after death in cold weather.

Anatomical Diagnosis.—Marked hyperplasia of the thymus gland with so-called thymus abscess in the left lobe. Enlargement of the mesenteric lymph nodes. Swelling of the spleen. Cloudy swelling of the liver and kidneys. Congestion and œdema of the lungs. Subpleural hemorrhages. Slight swelling of Peyer's patches.

The following notes are abstracted from the autopsy protocol:

The thymus gland is enlarged, covering at least one-half of the præcordia and reaching to within 2 centimeters of the diaphragm. The organ consists of two large lateral lobes, and between these two above is a triangular area of gland also made up of two lobes. The left lateral lobe measures 5 x 3.5 x 1.3 centimeters. On section the gland tissue is very succulent. There is a smooth walled cavity .5 cm. in diameter in the interior of the left lateral lobe from which an opaque yellowish-gray fluid can be squeezed.

Lymphatic Apparatus.—The bronchial glands are enlarged, as are the mesenteric glands, both being normal in appearance. The Peyer's patches of the small intestine are slightly enlarged.

Spleen.—Is free from adhesions. The capsule is smooth. The organ measures 7.5 x 4 x 2 cm. There are a few subcapsular hemorrhages. On section the pulp is somewhat increased. The Malpighian bodies are prominent.

The other organs show nothing beside the lesions mentioned in the anatomical diagnosis.

Cultures were negative.

Microscopic:

Thymus.—There is hyperplasia of the lymphoid elements. Degenerative changes in Hassal's corpuscles are present.

Lymph Nodes.—There is hyperplasia of the lymphoid elements. The germinal centers are prominent. There is marked proliferation of the cells of the germinal centers, particularly in the centers of the areas. The proliferated cells are at times swollen and some have undergone degeneration.

Spleen.—The Malpighian corpuscles show a pallor of their centers, which under the high power is seen to be due to proliferation of the cells in the center of the corpuscles, associated with some swelling and degeneration.

Case 5.—Illegitimate male child, 2½ months of age. St. Margaret's House. Service of Dr. Shaw.

The child did well after entrance and gained weight steadily. He was seen on the evening of his death at 7.30 p. m. when he looked well; when visited again at 9.30 p. m. he was

found to be dead. The autopsy was made 18 hours after death in fairly cool weather.

Anatomical Diagnosis.—Hyperplasia of the thymus gland with general hyperplasia of the lymphatic apparatus (status lymphaticus). Cloudy swelling of the liver and kidneys. Congestion of the lungs.

The following notes are abstracted from the autopsy protocol:

The *thymus gland* reaches from a point 1 cm. above the episternal notch to within 2 cm. of the diaphragm in the middle line. The organ measures 7 x 4 x 1.5 cm. On section it is normal in appearance.

The spleen measures 6 x 4 x 1.5 cm. The capsule is smooth. The consistency is rather soft. On section the pulp is normal. The Malpighian corpuscles are distinctly swollen, quite prominent.

Glands.—The mesenteric lymph glands are distinctly enlarged. The largest one measures 1.5 cm. in its longest diameter. They are normal looking on section. The cervical glands are slightly enlarged.

Intestines.—The lymphatic apparatus just above the valve and in the large intestine is slightly swollen.

The *tonsils* are slightly enlarged.

Cultures show the presence of the staphylococcus pyogenes albus and the pneumococcus in the lung. The other organs are sterile.

Microscopic:

The *thymus* shows hyperplasia of its lymphoid elements. The corpuscles of Hassal show the usual degenerative changes.

Lymph Glands.—A general hyperplasia is present and also focal lesions in the germinal centers in the form of marked proliferation of the clear cells. Occasional degenerated cells are to be seen.

Spleen.—The changes are limited to the Malpighian corpuscles. The centers show marked cellular proliferation with some degeneration. In a few places the vessels show proliferation of their lining endothelium.

Case 6.—Female child, 10 months of age. Private case of Dr. G. E. Lochner.

The mother of an apparently healthy female child, ten months of age, was in the habit of putting her to sleep in a baby carriage on the veranda while she attended to her household duties. On March 16, 1903, she followed her usual custom. Whilst working near an open window in the neighborhood of the baby carriage she heard the child move, and looking out at her saw her struggling. Thinking that she was merely struggling in her sleep she avoided going very close to her, but on returning and looking at the child a few minutes later she found her dead.

The autopsy was made 24 hours after death in cool weather.

Anatomical Diagnosis.—Hyperplasia of the thymus gland with so-called abscess of the thymus. General lymphatism most marked in the lymphatic apparatus of the mesentery and intestine. Swelling of the spleen. Cloudy swelling of the liver and kidneys.

The following notes are abstracted from the autopsy protocol:

The *thymus gland* is enlarged extending well down over the base of the heart. Its average measurements are 8 x 4.5 x 1.5 cm. It weighs 27 grammes. It consists of two distinct lobes, in one of which is a smooth walled cavity, containing what looks like hemorrhagic pus. The gland otherwise appears normal, though rather succulent.

Lymphatic Apparatus.—The bronchial glands are enlarged and succulent. The mesenteric lymph nodes are many of them enlarged, pale and succulent. The lymphatic apparatus of both the large and small intestine is exceedingly prominent. Peyer's patches stand out prominently. The solitary follicles appear as whitish, opaque, rounded nodules projecting distinctly from the surrounding mucosa which is quite pale.

The *spleen* is free from adhesions. It is softer than normal, but not increased in size. On section the pulp is increased, the Malpighian bodies are not particularly prominent.

The other organs show nothing beyond the changes noted in the anatomical diagnosis.

Microscopic:

Thymus.—There is marked hyperplasia of the lymphoid tissue. Degenerative changes in Hassal's corpuscles are present.

Glands.—There is general hyperplasia. Marked proliferative changes in the germinal centers with slight degenerative changes are noted.

Spleen.—There is marked hyperplasia of the Malpighian corpuscles which are diffuse. Slight proliferative changes are seen in the centers of some of the Malpighian bodies.

Group 2.—Cases of Infection Modified by Status Lymphaticus.

Case 7.—Male, 13 years of age. Private practice of Dr. W. O. Stillman.

The patient, a boy of 12 years, accidentally wounded himself on the inside of one of the fingers of the right hand while discharging a toy pistol July 3, 1900. The wound was a very slight one and attracted but little attention. It was treated with ordinary home remedies and appeared to be doing fairly well, although there was a very slight discharge from it. The patient remained in good health until Friday, July 6, when he complained of headache, chilliness, general malaise and sore throat. He was seen on Friday evening by a physician, who administered some palliative remedies. The patient had a very restless night Friday night, complained of most intense headache, pain in the back of his neck, as well as general aching through the muscles of the back, arms and legs. The temperature on Friday was somewhat elevated, between F. 100° and 101°. On Saturday morning the patient appeared to be somewhat worse, the temperature was in the vicinity of 101° F., the throat was quite sore and the tonsils decidedly swollen. The headache and other pains were about the same. The case was regarded as one of tonsilitis and treated as such. The patient's symptoms became somewhat worse during the day on Saturday and he passed an extremely restless and uncomfortable night Saturday night. Saturday

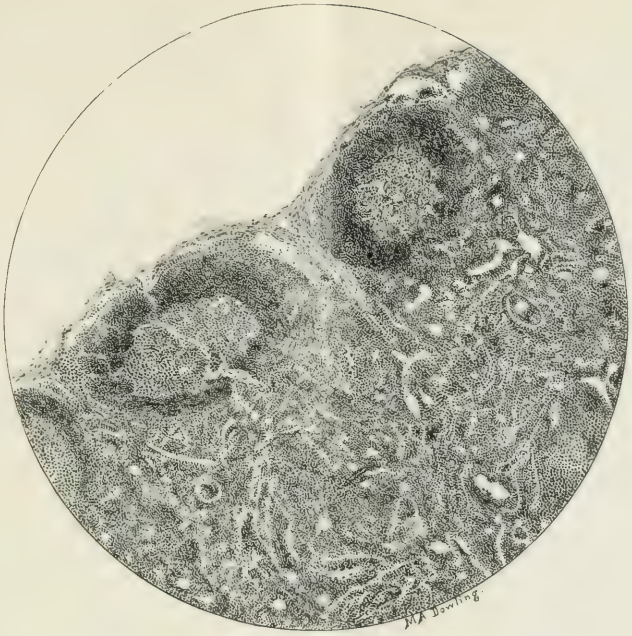


FIG. 1.—Low power drawing to show the changes in the lymph glands. General hyperplasia of the glandular tissue and focal changes in the germinal centers.

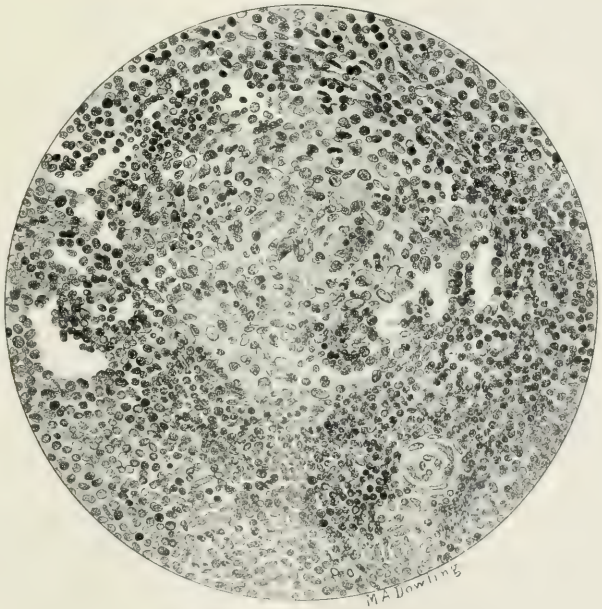


FIG. 2.—High power drawing showing the lesions in a Malpighian corpuscle of the spleen. The drawing shows the proliferative changes in the cells of the Malpighian body and slight degenerative changes.

afternoon he complained of some difficulty in opening the mouth, which at the time was attributed to the swollen tonsils. This difficulty became worse during the night, and on Sunday forenoon, about 10 o'clock, all of the patient's symptoms having become decidedly worse, he was suddenly seized with opisthotonos, and died in a few minutes.

The autopsy was done on the morning of the following day, Monday, by Dr. Elting.

Anatomical diagnosis.—Wound of left index finger. Tetanus. Enlarged persistent thymus. Cloudy swelling of liver. Congestion and cloudy swelling of the kidney. Acute spleen tumor. Hypostatic congestion of the lungs.

The following notes are abstracted from the autopsy protocol:

Over the middle phalanx of the left index finger on the inner side is a small ulceration 8 millimeters in diameter extending into the subcutaneous tissue, from which there is a slight purulent exudate.

Thymus.—Is persistent and enlarged, measuring 9 x 6 cm. in its greatest diameters. It presents two well-marked lobes. On section the gland presents at the tip of each lobe a small cavity about 1.5 cm. in diameter, containing a small amount of serous fluid; otherwise the tissue of the gland is normal in appearance.

Spleen.—It is free from adhesions. Measures 14 x 8 x 4 centimeters. The consistency is somewhat diminished, the Malpighian bodies are visible, the pulp increased and softened, the trabeculæ normal.

Glands.—The mesenteric are slightly enlarged, pale and homogeneous in appearance.

Cultures from the finger wound showed the staphylococcus pyogenes aureus and the colon bacillus; the same organisms were isolated from the throat.

Cover-slips from the finger wound showed numerous typical drum-stick tetanus bacilli with spores.

Microscopic:

Thymus.—There is hyperplasia of the lymphoid tissue with swelling and proliferation of the endothelial cells along the trabeculæ. Degenerative changes in Hassal's corpuscles are present.

Lymph Glands.—There is marked general hyperplasia. Slight proliferation in the cells of the germinal center is apparent.

Spleen.—There is hyperplasia of the lymphoid tissue of the Malpighian bodies. There is dilatation of the blood spaces with blood. There is an increase in the phagocytic cells of the organ.

Case 8.—F. S., male, 13 years of age. Albany Orphan Asylum. Service of Dr. T. M. Trego.

His family history is unknown. Personal history: He was never a strong child. He could not run around and take violent exercise with other boys of his age without becoming short of breath. His only illness was measles one year before his death. He was feeling perfectly well on the day of his death. After his evening meal he became cyanotic, had one or two general convulsions and died in 15 minutes.

Autopsy 17 hours after death. Cold weather.

Anatomical Diagnosis.—Great enlargement of the thymus gland with general lymphatism. Acute bronchitis with congestion of the lung. Cloudy swelling of the liver. Congestion of the kidney. Chronic gastritis with dilatation of the stomach. Meckel's diverticulum.

The following notes are abstracted from the autopsy protocol:

Thymus Gland.—Much enlarged, reaching to within 3 centimeters of the diaphragm on each side. It consists of three lobes, a central one in the shape of an elongated oval, measuring 6.5 x 3 x 1 cm., and on each side of this two triangular lobes with their bases at the neck and their apices and bodies lying over the pericardium; each of these bodies is 3.5 centimeters wide at the base, 10 centimeters in length and 1 centimeter in thickness. On section the substance of the gland appears normal.

Lymphatic apparatus.—The mesenteric glands are swollen and pale. The tonsils are much enlarged. The follicles at the base of the tongue are enlarged, and the intestinal lymphatic apparatus is swollen and prominent.

Spleen.—Is free from adhesions. The surface is smooth; consistency softer than normal. The Malpighian corpuscles are prominent. The pulp is slightly increased.

The other organs show no changes beyond those noted in the anatomical diagnosis. The central nervous system is normal.

Cultures show a general streptococcus infection, the organism was isolated from the lung, liver, thymus and kidney.

Microscopic:

Thymus.—Hyperplasia of lymphoid tissue. Increase in polynuclears. Degenerative changes in Hassal's corpuscles.

Tonsil.—Hyperplasia of lymphoid tissue. Marked increase in size of germinal centers. Proliferative changes in germinal centers. Slight degenerative changes. A few areas of necrosis with polynuclear infiltration.

Glands.—Hyperplasia of the lymphoid tissue. Proliferative and degenerative changes in germinal centers.

Lung.—Bronchitis and peribronchitis.

Group 3.—Death Under Chloroform in the Status Lymphaticus.

Case 9.—M. E. C., aged 7. Albany Hospital. Service of Dr. W. G. MacDonald.

The family history is negative. The child has had mumps, measles and chicken-pox. Several months ago she had an ulcerated tooth. Later she developed swelling of the face, with a temperature of F. 105° and convulsions. She was brought to the Albany Hospital, and the signs of necrosis of the jaw were detected. She was operated on for the removal of a sequestrum from the lower jaw and when the operation, which was not a severe one, was almost completed she suddenly stopped breathing. All attempts at resuscitation failed, even tracheotomy.

Autopsy 2 hours after death in cold weather.

Anatomical Diagnosis.—Hyperplasia of the thymus gland with general lymphatism. Cloudy swelling of the heart muscle and kidneys. Fatty infiltration of the liver.

The following notes are abstracted from the autopsy protocol:

The *thymus gland* is greatly enlarged, extending downward and covering the superior two-thirds of the præcordia. It measures 14 x 10 x 2 centimeters and weighs 30 grammes. On section it is normal in appearance.

Lymphatic Apparatus.—The mesenteric glands are enlarged throughout, some pale, others congested. The bronchial glands are enlarged and congested. Peyer's patches are considerably enlarged and congested, but not ulcerated.

Spleen.—Is not enlarged. Consistency softer than normal. On section the Malpighian bodies are swollen and prominent.

The other organs showed nothing but the changes noted in the anatomical diagnosis.

Cultures were all negative, except the culture from the lung, which showed two organisms: (1) the diphtheria bacillus, (2) a bacillus of the B. mucosus capsulatus group. Both organisms were tested on animals and found to be non-virulent.

Microscopic:

Thymus Gland.—The gland shows marked hyperplasia of the lymphoid tissue. There are very few Hassal's corpuscles left and these are degenerating.

Glands.—There is a general hyperplasia of the lymphoid elements. Proliferative and degenerative changes are present in the germinal centers.

Spleen.—Proliferative changes in the centers of the Malpighian corpuscles, accompanied by slight degenerative changes, are present.

Changes in the intestinal lymphatic apparatus, similar to those observed in the lymph nodes, are present.

A CASE OF SYPHILIS OF THE PERIPHERAL NERVES AND LUNGS.

By Charles M. Remsen,

From the Pathological Laboratory, Johns Hopkins University.

The rarity of syphilitic lesions of the lung has been a long-recognized fact, while syphilitic lesions involving the peripheral nerves, though common enough, have never been described histologically to any great length. In view of these facts, it has seemed justifiable to present this case, in which both lung and nerves have been involved, and in which, fortunately, it was possible to make a complete histological examination.

Nonne[1] has called attention, in his description of the clinical symptoms of syphilitic involvement of the peripheral nerves, to the possibility of the compression by syphilitic growth of nerves in their passage through the various foramina and at certain points along their course favored by anatomical relations. Occasionally there may be active changes going on in the nerve itself, principally in the inflammation of its membranes, or vascular changes affecting the supplying arteries, leading to atrophy, necrosis and caseation. The nerve roots may be involved in a diffuse thickening, or may have nodules scattered along their course; frequently, in the latter case, the administration of mercury has caused a complete clearing up and return of the affected nerve to the normal condition. Conditions such as these, he further states, have been observed clinically, principally as neuralgias—especially the trifacial form—and as syphilitic multiple neuritis, which is more frequent, but anatomical observations are lacking.

Berkeley[2] has made reference to two cases in which the peripheral nerves have been involved in syphilomata, and has given a very brief anatomical description of them in his paper.

Concerning pulmonary syphilis, the literature is abundant; and yet in this process we have a condition so rare that, according to one good authority, it could claim, in 1898, but ten undisputed specimens in all the London museums and hospitals. Fowler[3] states the possibilities of syphilitic conditions of the lung. Besides the bronchial catarrh which may occur during the period of incubation or during the secondary manifestations, he gives five principal modes of affection which may be evidenced in acquired syphilis, all belonging to the late tertiary period. (1) Gumma, which very rarely may break down to form cavities, but which far more frequently leads to the formation of dense cicatricial tissue. (2) Broncho-pneumonia—exceedingly rare. (3) Fibroid induration—frequently extending in from the hilus along the bronchi and vessels. (4) Changes in the bronchial glands and lymphatics of the lung. (5) Syphilitic phthisis.

Neumann has placed the conditions under three headings, namely, a diffuse lobar infiltration, a gummatous form, and and an interstitial pneumonia.

Hutchinson[4] agrees as to the rarity of the true pulmonary syphilis, but says the disease may attack the lungs at any stage. In the early stages, merely temporary congestion is observed, while later on local parenchymatous changes with a tendency towards retrogressive changes may occur. He

[1] Nonne: "Syphilis des Nervensystems."

[2] Berkeley: "Nerve Degeneration in Some Syphilitic Growths." Johns Hopkins Hospital Bulletin, 1891, No. 13.

[3] Fowler: "Disease of the Lungs." Fowler and Goodlee. Chap. xxxvii.

[4] Hutchinson: "Syphilis," p. 252.

thinks the process of infiltration far more common than the presentation of isolated gummata.

As to the seat of the lesion, there appears to be a more or less general opinion that the apex, which is most commonly affected in tuberculosis, is not usually the primary seat of affection, but rather the region of the hilus, or the middle lobe; while the possibility of excavation and cavity formation, so often observed in tuberculosis, seems very slight, judging from the frequent occurrence of final results which approach the condition of fibroid phthisis.

Councilman[5] has given a detailed description of two cases of pulmonary syphilis in which he urges the belief that hyaline degeneration of capillaries, possibly due to the action of the specific virus, is the first step in this pulmonary disorder. This is followed by atrophy of the alveolar walls, which is associated with a fibrinous exudate, epithelial proliferation, and other acute changes. The essence of the gumma formation is a pneumonia, with fibrinous exudation, associated with a fibrous thickening of the alveolar walls, the whole finally becoming caseous. He considers all cavities supposedly due to the excavation of gummata to be really bronchiectatic.

The case is one of a colored man, æt. 27, admitted to the Neurological Dispensary first in October, 1900, complaining of the loss of the use of his left forearm. The trouble dated back to June, 1899, at which time he was vaccinated on the left arm. Subsequent to this, his arm had swollen badly, become very painful and had been entirely useless for two weeks. The pain had lasted seven months, and then a sensation of pins and needles had set in. The weakness in his arm progressed so that in May, 1900, he could not extend his hand. The examination showed atrophy of the left arm; and though he could move his arm and forearm freely in all directions, the voluntary extension of the hand was impossible, thus giving a typical "wrist drop" position. The electrical examination showed weak reaction or no reaction at all in the muscles supplied by the musculo-spiral nerve, while further examination suggested slight involvement of the ulnar and median nerves. He was next heard from in April, 1902, when he was admitted to the Johns Hopkins Hospital complaining of hæmorrhage from the mouth. His illness dated back one year, when he had had a cough, bloody expectoration and shortness of breath, and, shortly before admission, a severe hæmorrhage from the mouth. The examination at this time showed marked atrophy of the left arm—the extensors in the left forearm being useless—and great tenderness existing along the course of the nerves. Râles and slight impairment over the upper left chest were made out. In less than one month, having gone rapidly downwards, he died during a severe hæmorrhage from the lungs.

The case was in no way to be distinguished from pulmonary tuberculosis, except that the examination of the sputum was negative for tubercle bacilli.

At the autopsy, both lobes of the left lung were extremely emphysematous. The apex of the upper lobe was firmer than the surrounding tissue, and there were a few scattered nodules on its surface. On section, just below the apex, was seen a caseous area, surrounded by scar-like tissue, fairly well demarcated from the surrounding lung. In the bronchus was a large clot, extending into the various branches. A large nodule in the lower lobe was found entirely caseous, with strands of grayish fibrous tissue running through it. The right lung showed various hæmorrhagic areas and a few firm nodules scattered on its surface. The lower lobe was almost entirely caseous, while section of the upper lobe showed a few circumscribed areas of caseation. The bronchial glands were enlarged and contained indefinite caseous masses. In the lower lobe there was a cavity about 3.5 cm. in diameter, fairly well marked out from the surrounding lung tissue, filled with blood, and having a bronchus opening directly into it; a probe could be passed direct from the pulmonary artery into this cavity.

The left arm was greatly atrophied and at a point in the axillary region there was found an irregular elongated mass of tissue about 2 cm. in thickness which involved the nerves and blood-vessels. Both above and below this mass the nerves could be separated and appeared macroscopically more or less normal. The artery was clear of thrombi, but the veins were quite occluded by a dark thrombus mass.

The microscopical examination of the lung shows various features, some of which predominate in some sections, some in others, so that it has seemed best for the sake of brevity to detail them as far as possible in one general description.

Large portions of the lung are free from very extensive pathological alteration, and show chiefly the results of the aspiration of blood into bronchi and alveoli subsequent to the hæmorrhage. In most of the sections, however, there is a consolidation produced by a combination of processes. Everywhere there are œdema and proliferation of the epithelial cells of the alveoli; in these areas and in many alveoli the desquamation of the cells is sufficient to fill up the lumen. Many alveoli contain also polymorphonuclear leucocytes and fibrin in considerable quantities, and eosinophile cells are especially abundantly scattered through the tissue. In many areas widespread organization of the exudate has occurred, so that the alveolar lumina are frequently almost entirely occupied by the plugs or columns of newly formed connective tissue. All of these processes, however, are relatively less striking than the great interstitial inflammation which affects the lung, especially about the areas of caseation mentioned. This leads to the great thickening of the alveolar walls and interlobular septa—sometimes by the appearance of abundant new connective-tissue cells with rounded nucleus and rather branchy cell body—at other times by the production of dense strands of elongated fibrous elements. This process may be so extreme as to render the alveolar lumen in each instance a relatively small cavity lying in a mass of fibrous tissue and separated from its neighbor; often such lumina are entirely pushed aside or obliterated. The process so far, then, is similar to such types of tuberculous pneumonia without the

[5] Councilman: "Syphilis of the Lung," Johns Hopkins Hosp. Bull. 1891, No. 11.

appearance of tubercles as are sometimes associated with the ordinary gelatinous and caseous pneumonia. Some caseous areas do occur here, and in places it seems that the lung tissue such as has just been described becomes necrotic or caseous en masse, so that the original alveolar structure can still be traced throughout the caseous material. In other instances we find that the caseation occurs really in the center of a large newly formed mass of epithelial cells with intercellular substance, vessels, etc., all of which are arranged together in a firm mass with radiating bands into the surrounding tissue. The central portion being approached, we find the epithelial cells finally giving way to fragmented nuclei which pass over into a red staining hyaline substance which represents the caseous material seen macroscopically. Even here one occasionally discerns the alveolar lumina, so that we probably have to deal here also with a successive interstitial new formation of tissue. Exactly this appearance is found in the wall of the cavity, which is made up of such indurated tissue with occasional distorted alveolar lumina inclosed, and composed largely of abundant epithelial cells without any evidence of circumscribed tubercle formation. Foci of coagulative necrosis with definite fibrin networks are continuous with the necrotic material which lines the cavity. In other portions of the cavity wall we find only a much thinner zone of indurated tissue, the necrotic lining of the cavity having been produced at that point by the caseation of the consolidated lung tissue and still showing its alveolar structure.

A similar proliferation of endothelioid cells with intercellular material is highly developed on the bronchial walls near the cavity, but caseation has not appeared there. The blood-vessels in these areas show frequently an extreme obliterative endarteritis, sometimes leading to the complete occlusion of the vessel, and in other cases there seems to be a development of new channels within the tissue, which leads to the obliteration of the old. The small vesicles in the tissue which is not densely consolidated are frequently surrounded by a zone of lymphoid cells.

Numerous sections through these areas studied with great care after staining by Mallory's method for the demonstration of tubercle bacilli failed to reveal any.

To resume, we have a focal affection of the lung in which œdema with the proliferation and desquamation of epithelial cells form the early changes. Associated with these come the exudation of a few leucocytes and the formation of a fibrin coagulum in the alveoli. In places caseation en masse supervenes, while in other areas, and especially about these areas of caseation, organization of the exudate and great interstitial proliferation of connective tissue occur. This latter in the form of masses of epithelioid cells displacing and obliterating the alveoli may also undergo a coagulative necrosis. No tubercles or tubercle bacilli can be found.

Superimposed upon this is an acute bronchitis and beginning bronchopneumonia due to infection with the streptococcus pyogenes which occurs in great masses in the bronchial exudate.

The examination of the nerves has proven interesting. Above the growth spoken of in the axilla no degeneration was demonstrable, the nerves appearing normal with the exception of one to two funiculi which show a slight increase over normal of the connective tissue nuclei. Through the lesion changes are seen which correspond well to the clinical examination. Here, an area taking in the artery, vein and nerve bundles, at the upper part of the lesion, shows a rather diffusely scattered growth, composed of cells with long and narrow nuclei, the latter being often bent and curved to form an irregular picture which corresponds almost exactly with the fibrous growth in the lung. This seems to infiltrate the connective tissue at will—in places densely cellular, at times almost devoid of nuclei—while some areas are even caseous. The artery shows a great thickening of the intima on one side, which, however, seems to bear no relation to the amount of infiltration of the adventitia by the growth at a corresponding point in its outer wall. Examination of the nerve bundles shows plainly the fact that where the growth is found surrounding the nerve bundles, degeneration has set in. One nerve bundle especially shows in the first place an infiltrated epineurium, while the perineurium and endoneurium are so densely infiltrated as to lead to the formation of thick fibrous bands in their places, the former of which lies always in close apposition to the separate funiculi. The perineurium is in some places infiltrated to such an extent that it forms a band thicker than the inclosed funiculus. In some places a whole funiculus is divided into a meshwork of interlacing strands of thick fibrous-like tissue, in the alveoli of which lies the degenerated nerve tissue. In some cases the tissue, which is densely cellular, shows commencing nuclear fragmentation and caseation to a slight degree. As for the nerve fibrils, the axis cylinders are greatly swollen and irregular, their appearance being, when viewed longitudinally, of irregularly thickened zigzag rods, the neurilemma throughout being intact. The myelin sheath appears swollen, but what is more marked is the exaggeration of its trabeculæ, which stand out most plainly as an irregularly interlacing network, in the midst of which may be seen the distorted axis cylinder. Fine pigment dots are scattered over the whole of the nerve tissue. Another nerve bundle shows the extreme degeneration; it is surrounded in the region of the epineurium by the intact growth. The epineurium itself is represented by a caseous, almost structureless, faintly staining mass, inside of which is an area in which with great difficulty may be seen the caseous "shadows" of the peri- and endoneurim. The fibrils of the different funiculi show no axis cylinders or myelin sheaths, and in fact are almost completely caseous.

In the lower part of the lesion practically the same picture is repeated, with perhaps the addition of more or less hæmorrhage especially in the involved perineuria, it occasionally being very extensive and infiltrating along the endoneuria and among the separate nerve fibrils. It might be noted here that one nerve bundle has passed down through these sections, showing no involvement by the growth in any region.

Below the lesion the arteries are normal, the veins thrombosed. The involved nerves show none of the caseous condi-

tion such as existed in the lesion where the nerve was directly involved, but rather a distinct retraction from the normal perineurium of the various funiculi, the intervening space (between nerve fibrils and perineurium) being filled by a very sparsely nucleated, loose, fibrillar network of connective tissue origin. Few intact axis cylinders or myelin sheaths are seen.

It is interesting to note the condition of the muscle below the lesion—probably the triceps—which shows great proliferation of the sarcolemma nuclei, which are frequently collected together into well defined groups. The fibers in many instances have lost their cross striation, and viewed from the side seem to pursue a rather zigzag course. Frequently the protoplasm takes no stain and only the cell outline is seen. Large areas have been supplanted by loose fibrous tissue.

The histological examination of the vaccination mark showed merely scar tissue.

To review briefly, therefore, we have a case clinically simulating pulmonary tuberculosis, in which repeated examination of the sputum for tubercle bacilli was negative and in which microscopical examination of the diseased portion of the lung has shown no tubercles or tubercle bacilli. The lesions in the lung are predominantly of the type of the diffuse syphilitic consolidation such as is described by Councilman, with definite areas of caseation and with organization of part of the exudate and induration of the lung by new growth of interstitial tissue. Especially interesting is the occurrence of cavity formation by the disintegration of the caseated tissue with erosion of a vessel and fatal hæmorrhage, which is so sharply in contrast with the finding of Hiller and Councilman, who expressed their belief that there can be no such thing as a syphilitic phthisis and that any cavities in such lungs are bronchiectatic. In the lesion of the nerves also there is no evidence of a tuberculous infection but every character of a syphilitic neuritis, with caseation of the new formed tissue and the nerves and consequent degeneration of these nerves and the paralysis and degeneration of the muscles which are innervated by them.

We may apparently assume from this case that the nodes or lumps observed along the nerves in certain patients suffering from syphilis, which disappear on the administration of mercury, are of a gummatous nature and if not disturbed may undergo caseation with the complete destruction of the involved nerves and subsequent changes in the muscle supplied by these nerves.

In conclusion, I wish to express my very great thanks to Dr. Wm. G. MacCallum, at whose suggestion and under whose supervision this work was done, for his kind assistance and advice.

THE MEDICINE AND DOCTORS OF JUVENAL.*

By Eugene F. Cordell, M. D.

(revised.)

In a paper read before this Society last year,[1] I endeavored to throw some light upon the medicine of Rome in the Augustan Age, by an examination of the writings of the Latin poet, Horace. So far as I could find, there was no article dealing with his works from this point of view. As an attaché of the Imperial Court and a favorite of the great Prime Minister, Maecenas, Horace must have come in daily contact with men of all classes, so I felt sure that he would have something of interest to say regarding the state of medicine and the medical profession in the great Roman metropolis. My researches were amply rewarded, bringing to light, among other things, an unexpected and most agreeable addition to our knowledge of those times, in the fact of the close intimacy existing between Horace and Celsus, the great medical writer of the Augustan Age; at the same time furnishing some interesting details regarding the almost unknown personal history of the latter. To-night, let us turn our attention to Juvenal—in full, Decimus Junius Juvenalis Aquinas. Please note the threefold appellation, indicating distinction; and I would call your attention especially to the last name, or agnomen, indicating that he was a native of Aquinum (a town of the Volsci in Latium), because it corresponds with the analogous title of Albinovanus given by Horace to Celsus; Juvenal of Aquinum, Celsus of Albinova.

Of all Roman writers of their times, Horace and Juvenal give us most insight into the customs and manners of their countrymen. As satirists, they deal especially with the growing and fatal degeneracy of the Romans, and yet with a pronounced difference of method. Horace, self-indulgent, lax in life and morals, himself not untouched by the sins and weaknesses which he condemns, yet frank and free from meanness, servility and hypocrisy, more human and therefore less perfect, but with all his weaknesses, more lovable; Juvenal, strict in life and morals and intolerant of vice in others. Horace, not separated from us by any class distinctions; Juvenal, a member of the legal profession, a distinguished advocate, and naturally approaching his subject from the point of view of a prosecutor. Horace, with more observance of the proprieties of speech, attacks vice by rendering it ridiculous; we can almost see the merry twinkle of his eye and hear his half-suppressed laugh as he sees his victims scamper across the stage, pursued by the shafts of his wit and irony, and catch

* A paper read before the Johns Hopkins Historical Club, Baltimore.

[1] Johns Hopkins Hosp. Bull., 1901, xii, p. 233.

his whispered aside, "They are not much worse than the rest of us after all." Juvenal is plain almost to the point of brutality, and holds up vice to our gaze in all its hideous nakedness; he shocks us with the wickedness of his times, and renders his victims utterly hateful and despicable; he is above sympathy and affection, he has no humor or pity, and he never smiles; he deals out his fierce invective with the sternness of an implacable judge, sparing none; he is like some irate Jove hurling thunderbolts from a mountain top with his red right hand. Horace deals more with vice in the abstract, the follies of the classes and the masses, often with the mere weaknesses of poor human nature; vice had advanced with rapid strides by Juvenal's time, and a more drastic method was called for. Juvenal attacks individuals directly; he seizes and holds them—they cannot escape until he has wreaked his vengeance; he loves, too, to aim at high prey—the wife of a great Senator eloping across the sea with a scarred gladiator—the Empress Messalina standing naked in the common brothel and prostituting herself for pay to its patrons—even the Emperor himself, through his favorite actor, Paris. Let us see what this *clarus satyricus*—this *princeps satyricorum* has to say of medicine in his day.

Before proceeding with this, I would remark, that, as in the case of many other great men of antiquity, but little is known of his life. He probably lived between A. D 20 and 100, and he attained a great age. He was the son or foster-son of a rich freedman and had the advantage of a learned education, pleading causes at Rome with great reputation in the time of the Emperor Claudius, A. D. 41 to 54. He never knew Horace, who died 8 B. C., but he probably knew Celsus, who is believed to have written the last part of his great encyclopedia, that upon medicine, in the latter period of his life, about A. D. 40.

You will recall the confidence, the homage, the obedience shown to the physician by Horace. We cannot expect such a frame of mind in Juvenal, whose faith could never blind him to the imperfections and the weakness of the immature profession of his day. Accordingly, in the famous SatireVI., we find a certain Greek surgeon, Heliodorus by name, represented as engaged in castrating the young slaves who have just reached robust puberty—"*bilibres testiculos*"—in order that their mistresses may use them with impunity for the gratification of their lusts. A physician of this name is said to have practised at Rome during the reign of Trajan (A. D. 98-117), and to have written upon surgical subjects, but his writings have nearly all been lost. It is a pity that his memory did not share a similar fate, and we can only hope that his case was a solitary one, even at Rome.

A fling is made at the profession in Satire X.; I quote the entire passage, which is of literary as well as medical interest. Speaking of old age and of the dangers which threaten it, he says: "Moreover, the scanty blood which flows in his chill body is warmed by fever alone. All kinds of diseases dance round him in a troop. If you were to ask their names, I could sooner tell you how many lovers Hippia" (the eloping Senator's wife) "had; how many patients Themison has killed off in a single autumn (*quot Themison ægros autumno occiderat uno*); how many partners Basilus has cheated; how many wards Hirrus has defrauded; how many men tall Maura has submitted to the embraces of in a single day; how many pupils Hamillus corrupts." Themison is here used for the profession in general, and the selection shows his prominence at Rome. The association of the name with lewd women, false guardians, corrupt teachers and dishonest merchants, enhances the sharpness of the satire. Who, then, was this Themison, the profession's representative in infamy? He was a Greek physician of Laodicea, a pupil of Asclepiades of Bithynia, who settled in Rome about the last half of the first century B. C. He lived, therefore, before the time of Juvenal, and he was the immediate predecessor of Celsus, who refers to him in six places. "Asclepiades," says Celsus in his preface, "changed in great measure the art of healing. Themison, one of his successors, has lately, in his old age, differed from him in some things. The profession of medicine has been greatly improved for us by these eminent men." Themison was the head of the sect of Methodists, whose tenets Celsus gives in the following passage: "Some physicians of our own age under the authority of Themison (as they wish it to appear), contend that a knowledge of the cause can have no influence on the treatment, and that it is sufficient to observe some of the most common affinities of diseases, of which there are three kinds: 1. Constipated; 2. Relaxed; 3. A mingling of these two. For sometimes the secretions are too scanty, sometimes too abundant, or too scanty in one part and too abundant in another. Diseases, too, are sometimes acute, sometimes chronic; they may be progressing, at their acme, or on the decline. Now, when the complaint arises under any of these circumstances, if the body be constipated, it should be relaxed; if it suffer from a flux, this should be restrained; if it take on a complicated character, we must relieve the more violent manifestations. We ought also to treat an acute disease differently from a chronic one; one that is progressing, differently from one that is at its acme or on the decline. Such principles and action constitute the theory and practice of medicine—a certain way of proceeding which the Greeks call method (μεθοδος)." Later, as we learn from Celsus, the disciples of Themison were not all in entire agreement as to their doctrines. Celsus also gives a composition for the ear, devised by Themison. He is also mentioned by Pliny, Seneca, Soranus and Cælius Aurelianus, and some of his teachings have been preserved for us in the writings of the last two authors. He was the author of a work on chronic diseases, was the first to introduce leeches into practice and the first to write upon elephantiasis.

In Satire III., among the crowds of foreigners who had flocked to Rome, attracted by the hope of gain or plunder, a Greek adventurer is depicted, a sort of jack-of-all-trades "with a quick wit, desperate impudence, speech ready and more rapid than that of Isæus" (the preceptor of Demosthenes), ... "grammarian, rhetorician, geometrician, painter, anointer, soothsayer, rope-dancer, physician, wizard—

he knows everything. A hungry Greek will go into heaven if you command!"

"Doctor Trypherus" is mentioned in Satire XI., but he was a doctor of the art of carving, not of medicine, although one cannot be certain that he was devoted exclusively to this pursuit—he may have added it to the long list of accomplishments of the Greek.[1a]

In Satire XIII., a physician by the name of Philip is referred to, whose insignificance is emphasized by the words of the satirist: "Let doubtful cases be treated by greater physicians; you may safely entrust your vein to a pupil of Philip," *i. e.*, your case is so simple, you are so manifestly insane that it requires no professor in the art to treat you—a mere novice may bleed you.

There are some other references to doctors. In Satire VI., which deals with the wickedness of the Roman women, an adulterer, impersonating Archigenes, a physician, is admitted by a mother pretending to be sick, in order that he may have secret intercourse with her married daughter. Strange to say, there is no intimation that the physician was in any way an accomplice to this fraud. Archigenes was a native of Apamea in Syria, a contemporary of Heliodorus, and died at Rome in his seventy-third year. He is referred to with respect by Galen twelve times, and by Cælius Aurelianus once. He was an Eclectic and enjoyed considerable reputation as writer, practitioner and surgeon. In surgery, among other things, he described amputation with preliminary ligation of the main vessel of the limb. Only a few fragments of his writings, which took a wide range of subject, are preserved in the works of Cælius Aurelianus, Galen, Oribasius and Ætius. He is mentioned again by Juvenal in Satire XIII.: "Let not the runner, who is in his senses and therefore does not need the services of the physician Archigenes, hesitate to wish for the rich man's gout," *i. e.*, for wealth even at the cost of health. And again in Satire XIV.: "Already your long and stag-like old age torments your heir; make haste, and look up Archigenes and purchase from him the compound of Mithridates, if you wish to pluck another fig or again to handle roses," *i. e.*, to live longer. "You must get the antidote which a father no less than a king needs before meals."

When his friend Ursidius contemplates marriage and thinks he has found a chaste wife, Juvenal exclaims in Satire VI.: "O physicians! open the middle vein, he is mad!" This refers to the custom, then prevalent, of bleeding insane persons from the *vena media* of the arm.

In Satire VI., the physicians are represented to have been sad when a child whom they were attending became very ill, but there is no intimation that their sorrow was unreal.

There are fewer references to diseases and operations in Juvenal than in Horace: "Corruption is communicated, as when in the fields a whole herd falls by the scab and measles of one swine";[2] "dogs are rendered hairless by an old mange"—*scabie vetusta.*[3]

Referring to the marriage of males, a practice in vogue among the upper classes at Rome and mentioned also by Horace, and to those who imitated women, he says:[4] "But what do they wait for, for whom it is now high time in the Phrygian manner to cut away their superfluous flesh?" *i. e.*, to castrate them. The gladiator with whom the senator's wife eloped is described[5] as being adorned with "a great wen in the middle of his nostrils," *ingens gibbus, mediis in naribus*, probably some large tumor caused by repeated blows upon the part. Nor was this his only attraction; he had also[6] "the sharp evil of an ever-dropping eye," *acre malum semper stillantis ocelli*, fretting and disfiguring his face. "But he was a gladiator! This makes them hyacinths! Him she preferred to her children, her country, her sister and her husband. It is the sword they love."[7]

In Satire VI., the Roman husband is represented as driving from his house his wife who is growing old and losing her charms: "Collect your traps and get out," says his freedman, "you wipe your nose too often; quick, make haste, there comes another with a dry nose"—*sicco naso*—*i. e.*, a young wife. In the same Satire, it is said that certain things would excite even the passion of Priam and the hernia of Nestor; that is, neither age nor even bodily defects are protections against them. Nestor, King of Pylos, is said to have lived three ages and to have had a hernia. Whether it was a genuine hernia or not, is uncertain, since several affections of the scrotum and adjacent parts were included under this name. We have, also, a woman consulting an astrologer about the death of her "jaundiced mother"—*ictericæ matris.*

We find also the expressions *quartana, quarta dies torrens*, "quartan fever"; *varicosus haruspex*, "the broken-veined soothsayer"; *furor*, "madness"; *phrenesis*, "insanity"; *loripes*, "a youth with club-foot"; *strumosus*, "a scrofulous person"; *Rutilæ gibbus*, "the hump of Rutila"; *phthisis et vomicæ putres et dimidium crus*, "consumption, putrid abscesses and a shriveled leg"; and *podagra*, "gout." Senile dementia is described; circumcision is alluded to in the expression *præputia ponere*, and the birth of triplets recorded in the words *pueros tres in gremium patris fundere simul.* There was a priest of Bellona who emasculated himself with a broken shell, *mollia qui rupta secuit genitalia testa.* Depilation of the body was practised by the young rakes of Rome—*resinata juventus*, "the perfumed youth"—in order to render themselves more inviting to the arms of their paramours.[8] Pliny, also, refers to this practice:[9] "*pudet confiteri maxi-*

[1a] The term "Doctor" meant at that day "Teacher" and was not applied to physicians, as now, until modern times.

[2] Satire II., 80. [3] Satire VIII., 34. [4] Satire II., 115.
[5] Satire VI., 108. [6] Ibid., 109.

[7] Two years ago, there appeared in a New York paper an account of the elopement to Europe of a celebrated prize-fighter and a charming young actress. "Jim," she is reported to have said, "why do women adore a conqueror of men? You are indeed a gladiator that all Rome might have been proud of"; and the actress smiled sweetly and tossed a small bouquet into the fighter's lap. This episode and the recent experience of a young naval officer, show that 2000 years have not dissipated the hero-worship of women. [8] Satire VIII., 115. [9] Liber XIV., 20

mum jam honorem esse in evellendis ab virorum corporibus pilis." The operation of excising growths about the anus is thought to be referred to in Satire II.: "*Podice lævi cæduntur tumidæ, medico ridente, mariscæ.*"[8a] Goitre and a peculiar hypertrophy of the breast, not understood by the annotators, are referred to in Satire XIII.: "*Quis tumidum guttur miratur in Alpibus, aut quis in Meræ crasso majorem infante mamillam?*"—"who marvels at goitre in the Alps; who, in Mercæ, at the breast larger than a fat baby?"

There are still fewer allusions to the organs and remedies. The liver is mentioned as the seat of anger but not of lust, as in Horace; "*substringere bilem*" is to restrain one's anger only; the heart presides over the intelligence. Both *stomachus* and *venter* are used for the organs of digestion. *Ægrum cor,* is a distempered heart; *cerebrum,* head; *viscera,* intestines; *lumbi,* loins; *pulmo,* lung—"to shake one's lungs with laughter"; "the lungs burn with wine." We also meet with the words, *guttur, vena, medulla, præcordia* and *alvus.*

The idea of diseases being manifestations of the wrath of an offended deity, common among the ignorant and superstitious in all ages, is conveyed by the lines "Moreover if they have begun to suffer a pain in the side with a sleepless fever, they believe the disease sent to their body by some hostile deity; they think these things the stones and darts of the Gods."[8b]

Among drugs, hemlock is mentioned: "Athens bestows nothing but cold hemlock" (*gelidas cicutas*) "upon poor Socrates." The herb *eruca* (rocket), referred to in Satire IX., is said by Celsus to cause a burning sensation and to act as a diuretic: "Do thou only impress thy tooth on rockets," says Juvenal to Nævolus, the professional panderer, "and another greater hope remains to thee." Ovid[10] calls it "*eruca salax.*" Tigellinus, the infamous favorite of the Emperor, gives *aconita* (wolfsbane) and other poisons, to three uncles.[11] In Satire VII. we find the expression: "What mortars (*mortaria*) now heal blind old men?" Bleeding was in general and perhaps, from an expression of Celsus, in excessive use at this time, and is often referred to. It was either general—from the arm—or by cups (*cucurbita ventosa*). These cups were made of horn or of brass, and were also applied dry for their derivative effect. Leeches are not mentioned. The celebrated antidote of Mithridates, King of Pontus and Bithynia, "by taking which daily, that monarch is said to have rendered himself proof against the dangers of poisons" (Celsus), is alluded to in Satire XIV. Its heterogeneous ingredients, thirty-seven in number, are given by Celsus, who directs that they be bruised, mixed with honey, and a piece the size of a sweet almond be given in a glass of wine. It is hard to comprehend how a composition which appears to us so worthless, and which has fallen into such deserved neglect, ever could have had the reputation that this had. Such experience is calculated to impair our confidence in human judgment and in modern "specifics."

The use of the *fibula* or clasp, applied to the prepuce of young actors and singers to prevent copulation and preserve the voice, is mentioned several times by Juvenal. Celsus[12] describes the operation of infibulation, as follows: "Some surgeons have been accustomed to infibulate youths, sometimes on account of the voice, and sometimes of the health. It is done as follows: the skin covering the glans is drawn out, marked on either side at points where it is to be perforated, and then released. If the marks return over the glans, too much has been taken up and it ought to be marked nearer the extremity. If the glans be free from these, that is the proper place for the clasp. Then, where the marks are, the skin is pierced with a needle and thread and the two ends of the latter are tied together. The thread is now pulled back and forth daily, until small cicatrices form around the openings. When these have become strong, the thread is removed and a fibula is applied, which is the better as it is the lighter." This operation does not seem to have been always an effective barrier to the fair Romans, for Juvenal says:[13] "*Solvitur his* (*i. e., feminis*) *magno comœdi fibula.*" And again:[14] "*Si gaudet cantu nullius fibula durat vocem vendentis prætoribus.*" And Martial says: "*Fibula quid præstat? carius ut futuant.*" Celsus,[15] as we might suppose, disapproves of the operation: "*sed hoc quidem sæpius inter supervacua quam inter necessaria est,*"—"but this operation is oftener superfluous than necessary." It is not mentioned in the works of later Greek and Roman physicians, such as Galen, Aurelianus, Ætius, Paulus Ægineta, and would appear, therefore, to have fallen into early desuetude. An analogous operation is said to have been practiced upon girls by passing a ring or pin through the labia so as to close the vaginal orifice. According to Ploss, the Nubians and many other races still practice it as part of their religious ceremonial (Williams, *Obstetrics,* p. 25).

Juvenal repeats the complaints of the deadly autumn, "*autumnus letiferus,*" which we found so frequent in Horace.

"*Taberna,*" Satire II., was a shop where perfumes, "*opobalsama,*" etc., were sold, and was presided over by the *pharmacopola.* You will recall how Horace describes the *pharmacopolæ* as grieving over the death of their patron, the singer Tigellius. It is probable that they were the dispensers of medicines to the poor, as there were no drug-stores proper at Rome.

As bearing upon the daily experience of the medical contemporaries of Juvenal, as they went about visiting their patients, and also as indicating the source and character of some of their practice, may be cited, in conclusion, some remarks upon the condition of the streets and houses and the insecurity of life at Rome, to be found in Satire III., where Juvenal's old friend Umbritius is leaving the city in disgust. A thousand perils environ the citizens of the fell city. The unsafe condition of the dark houses is first depicted; according

[8a] The *podex lævis* is also referred to by Martial. It and the *mariscæ* were results of unnatural practices (pæderasty). See J. Maschka, *Handb. d. Gerichtl. Medicin,* Band. III, Tubingen, 1882, pp. 182, 183; also J. Rosenbaum, *Geschichte d. Lustseuche im Alterthume,* Halle, 1882, pp. 135, 137.

[8b] XIII, 229. [10] *Remedia Amoris,* 799. [11] Satire I., 158.

[12] Liber VII., 25, 3. [13] Satire VI., 73.

[14] Satire VI., 378. [15] Liber VII., 25.

to Umbritius, a great many of them are supported with props which however do not prevent their frequent falling, and there are many chinks and gaps in the ancient walls; fires are of common occurrence. Owing to the great noise in the streets, none but the rich can sleep, and many an invalid dies from want of rest. For a stream of carriages is continually passing in the narrow and crooked thoroughfares, and the drivers are perpetually engaged in noisy disputes and foul abuse of one another. If you are in haste, your passage is obstructed by the crowd. A rich man's litter, borne aloft upon stout shoulders, jostles you aside; those behind press upon your back; one man digs into you with his elbow, another with a hard pole; your shoulder is struck by a joist, your head by a beam, and a cask is thrust against your shins. Your legs are bespattered with mud, on all sides you are trodden on and the nail of a soldier's boot sticks in your toe. The cooks scatter the burning coals as they hurry by with their patrons' meals, and your clothing is torn into shreds. One wagon loaded with a fir-tree, another with a huge pine, shake the streets as they advance, the ends waving to and fro, threatening the people. Another wagon is loaded with stones from the quarries of the Apennines, and woe betide if the axle break and the mass be precipitated on the people. Who could find their scattered limbs or gather up the carcasses ground to powder? Then there are the dangers of the night when broken crockery, thrown out of the lofty windows, makes dents in the pavement and threatens to break one's skull. Indeed, there are as many fates awaiting you as there are open windows where you pass. You may thank your lucky stars if they throw only the contents of the basins and pots upon you. Rash will he be thought who goes to supper without having made his will. Or your life is put in jeopardy by some drunken and ill-tempered fellow, ready to pick a quarrel with the first person he meets. He takes care to avoid the scarlet cloak and the long train of attendants, the many lights and the brazen lamp, but you whom the moon alone attends, he despises. Or you meet a worse fate if you fall into the hands of the numerous robbers, driven by the soldiers out of their lairs in the neighboring Pontine marshes and forced to seek refuge within the city's limits.

This language may appear exaggerated, but Horace[16] speaks in similar strains, inveighing against the noise and smoke, and telling of "a builder in heat who hurries along with his mules and porters: the crane hurls aloft at one time a stone, at another a great piece of timber: the dismal funerals dispute the way with the unwieldy carriages: here runs a mad dog, there rushes a sow begrimed with mire."

And Propertius speaks of similar dangers in the line:

Præterca domibus flammam, domibusque ruinam.

Such are the all-too-brief glimpses of medical life and thought in imperial Rome which we glean from the writings of the greatest satirist of all ages.

[16] Epist. II., 2, 72.

NOTES ON NEW BOOKS.

Saunders Question Compends. Essentials of Histology. By Louis Leroy, B. S., M. D., Professor of Histology and Pathology in Vanderbilt University Medical and Dental Departments, Bacteriologist to the State of Tennessee, Pathologist to Nashville City Hospital. 263 pages with 92 illustrations, second edition revised and enlarged. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

This book contains a short account of the principal points in histology. The facts contained are in the main correct, but it is not to be recommended to those desiring more than the most superficial view of the subject.

Bacteriological Technique. A Laboratory Guide for the Medical, Dental, and Technical Student. By J. W. H. Eyre, M. D., F. R. S., Edin., Bacteriologist to Guy's Hospital, and Lecturer on Bacteriology at the Medical and Dental Schools, etc. Octavo of 375 pages, with 170 illustrations. Cloth, $2.50 net. (*Philadelphia and London: W. B. Saunders & Co., 1902.*)

The methods of bacteriological technique have of late years so multiplied that some method of easy access becomes very desirable. The present book gives an account of the ordinary methods in use in bacteriology and also many of those used for more special purposes. The use of the terminology introduced by Chester is to be commended as tending to simplicity and rendering the descriptions of bacteria and their cultural characteristics more uniform.

The omission of *Bacillus dysenteriæ* (Shiga) from the pathogenic bacteria considered will probably be rectified in a future edition. The book as a whole is to be commended as fairly well representing the present methods used in bacteriology.

Transactions of the American Rœntgen Ray Society. Third Annual Meeting, Chicago, Ill., December 10 and 11, 1902. (*Louisville: Courier-Journal Job Printing Co., 1903.*)

The Transactions of the American Rœntgen Ray Society will be read with great interest by those interested in the advancement of the science of X-ray. The present report, besides giving the details of the organization of the Society, contains a number of most excellent articles.

These articles for the most part deal with the therapeutic value of the X-ray. A careful study of the data given seems to show that omitting the analgesic effects the value of the X-ray on deep-seated growths is limited; but on the other hand its use in the treatment of superficial growths and other forms of skin lesions has markedly increased.

The paper of Dr. T. P. Hall entitled X-ray Physics deserves more than a passing notice. We have given us in a short, concise form all the physical properties of the ray and the various theories as to its nature. The greatest stress, however, is laid upon the generally accepted theory, that this form of energy is merely a series of very short waves given off from the anode when it is bombarded by the cathode ray. This theory explains quite readily why the penetration varies according to the atomic weight of the substance examined.

In another part of the report attention is called to the fact that burns can be produced just as readily with the static machine as with the coil. The three factors in the production of a burn; namely, the amount of energy sent through a tube, the length of exposure and the frequency of exposure; must be considered just as much when the static machine is used.

The report makes a useful addition to the library of a radiographer.

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AN EPITOME OF THE HISTORY OF CARCINOMA.[1]

By Roswell Park, M. D., LL. D.,

Of Buffalo, New York, Professor of Surgery, University of Buffalo.

No one can scan the voluminous literature of cancer without being at first bewildered by the confusion of names and the loose and almost meaningless way in which the term and its various synonyms have been used. It is bad enough even to-day when one writer describes a growth as cylindroma and another writer rejects the term. If this be bad to-day when we have reasonably accurate notions of what constitutes cancer, how much worse must it have been centuries ago when a hundred different conditions were described under the same general term. It does not seem worth while to go back to the beginning of the Christian Era since the writers who followed Hippocrates simply represented his views, and we do not need to trace them into antiquity. Let us then begin with Celsus who wrote carcinoma in its Latin spelling and did not use the Greek karkinoma although many of his translators have done so.

In his day and long after ulcers of all kinds were confused

[1]Read before the Historical Club of the Johns Hopkins Hospital, May 11, 1903.

with tumors of all kinds, which will account for his making particular mention of venous stasis and swelling veins, and noting the fact that sometimes carcinoma causes pain and breaks down into an ulcer and at other times does not. He took this view—that if the actual cautery produces no bad effect the disease is curable, whereas if the growth is stimulated by the cautery it is a carcinoma, and active therapeutics must be discontinued. It is a curious fact that the theory of the development of cancer given by Celsus should be made the basis of an essay by Schmalz in 1825 (*Surgical Treatment and Surgical Diagnosis*).

The early writer and his late imitator distinguish some sixty or more different kinds of ulcers, among them those due to a peculiar diathesis, i. e., cancerous; and so he described ulcus cancrosum, cancer apertus, cancer genuinus, noli me tangere, open cancer, glandular cancer, etc. Celsus used frequently the term cacoethes in the substantive sense, whereas Schmalz uses it as an adjective, i. e., cancerlike. In his clinical descriptions Celsus was painstaking and often accurate. In fact he used adjectives very freely. Chironium and telephium were terms applied to an ulcer accompanied by severe pain, induration, and general formidable appearance with tendency to spread. Such terms might apply equally well to a malignant ulcer or a chancroidal bubo.

According to the Celsian view, should the suspected ulcer not improve under appropriate treatment it was certainly a cancer, but no one could make the decision without time and experiment. Writing of this Thiersch quoted the *bon mot* of Duparque to the effect that "cancer is incurable because it cannot be cured; the reason we cannot cure it is because it is incurable; therefore if one by chance should happen to cure it, it must be that there was no cancer." They had in those days also what was called thymium, a lesion of doubtful character, about which there was much uncertainty. Celsus remarks that "it is like a wart and therefore in some respects must be different, but occasionally it is found on the surface of an ulcerating cancer. Nevertheless it has an independent growth of its own."

This would look like the so-called proud flesh of the laity, as the expression, "then comes the ulcer and from it the thymium," would imply. This word, by the way, is spelled also tymium and timium. The expression seemed to the writers who used it very apt, although the younger Pliny used it in the sense of a simple swelling, and applied it indiscriminately to a boil, a pile, or a condyloma. The thymium was not very different from what was called akrochordon, which was described as a species of wart, sometimes very painful, ovoid in shape, connected to the skin by a slender stem and known as the "hanging wart." It was so called because the cutaneous surface resembled the cut end (akros) of a harp string (chordo). According to some descriptions the former would appear to be a simple horny outgrowth from the skin, and the latter a fungous papilloma; according to others, who use the expression "pessimæ," we are compelled to regard them as something more serious. In addition to the terms now strange to us, above mentioned, Celsus also used the words murmakia and clavus, which latter is still in use. Clavus in his day seems to have signified a pus producing swelling.

Celsus seems to have been conversant with the step by step process of infection, both malignant and pyogenic, but I think that we waste time in trying to determine more minutely just what he in his day meant by these terms which I have thus far rehearsed. So late as 1777 Blancardus contented himself with presenting this subject practically in the language of Celsus, adding nothing thereto, and having in his preface scarcely a word to say for himself on the subject; but the more one examines Blancardus the more evident it is that he was destitute of enterprise in medical research. There is no question that Celsus lived at a time when men had no use for the exact sciences, as even the elder Pliny acknowledged. The world was given over to excess and debauchery, and the worst form of imperialism controlled Roman thought. Medical literature of that date consisted mainly of formulæ for cosmetics, and while the baths were conducive to health and to cultivation of artistic taste, they were destructive to public morality. Some effect was produced by the alarm voiced by Plutarch and Tacitus, by the merciless satires of Juvenal and Perseus, and by the well-directed philosophy of Seneca.

In the year 131 Galen was born at Pergamos, and he finally appeared in Rome as the private surgeon and medical adviser of the young Commodus. He curiously mingled philosophy and medicine, and combined with the humoral pathology of Hippocrates a pneumodynamic theory mainly his own. To him the malignant character of cancer was well known, and he added to the views of his day concerning its internal manifestations. "In the breasts we often find a tumor in size and shape closely resembling the animal known as the crab, for as in the latter the limbs protrude from either side, so in the tumor the swollen veins radiate from its edges and give a perfect picture of the crab." Here will be seen, perhaps, the first publicly stated reason for giving to this disease this particular name. He also busied himself with its treatment and, while he considered cancer to be the product of black bile, was not opposed to operation, but gave this advice: first to get rid of the black bile by appropriate remedies and then to attempt a cure by milder applications, since "the more severe remedies merely increase the evil." He told us that there are many metallic compounds which, taken with purgatives, have a beneficial effect upon the disease in its early stages, including that if one is "minded to try the cure of cancer by surgery he must as before begin by purging the evil humor, and then immediately proceed to the removal of the diseased part so thoroughly that there shall be nothing of it left, by letting the blood flow freely and being in no haste to check it, but rather squeezing out the thick black blood from the swollen veins." Galen thus showed that he recognized that cancer possessed a malignancy peculiarly its own, for which reason he advocated the combination of medicine and surgery.

Galen operated for cancer with the knife and cauterized the wounds not alone for hemostatic purposes but for the destruction of any remaining diseased tissue. He noticed that

successful results occurred when the operation was carried out, and his language, as well as his actions, show that he was familiar with true carcinoma, although he was not aware of the function of the lymphatics. He nevertheless was earnest in calling attention to what he knew of metastasis, even through the venous circulation. Evidently with him, also, it was not only the amount of the humor but its character which determined the subsequent growth, but he says it is the thinest of these humors which gives rise to the herpetic ulcer while the thicker causes cancer. Galen's general pathology was a sort of organic theory of disease. He maintained—in opposition of Archigenes—that it is always by reason of disordered function that a part becomes diseased, and that an organ can only become directly diseased as a result of transmission from other diseased foci. Hence we can readily understand his object in always preceding an operation for cancer by a system of general treatment. If, therefore, he became enthusiastic in his praise of phlebotomy, or in his use of purgatives, we must give him credit at least for some sort of rational basis for his therapeutics.

Following the death of Galen medicine entered upon a period of quiescence if not somnolence. Leonidas of Alexandria, some 200 years after Christ, wrote as follows, if we may trust Aetius: "If, therefore, the breast be entirely involved in the scirrhotic growth so that the surrounding part is endangered should an amputation be attempted, under no circumstances should we operate. If, however, the apex or only one-half of the breast be included in the growth the breast should be removed, and the wound cauterized." When he feared hemorrhage he often operated in two sessions, for he says: "I then cut a second time and dissect out the whole breast and afterwards cauterize the wound, often repeating the cautery." The first cautery was for hemostasis, the second for the extirpation of infected tissue.

For several centuries nothing of interest transpired until we come to the writings of Alexander of Tralles, who excelled rather in treatment than in diagnosis. In his ninth book he discusses cancer and offers several methods of treating it from a humoral point of view. Among other things he highly praises the treatment of cancer of the liver by the use of chalybeate waters.

The work of Paul of Aegina is mainly a compilation, in the fourth book of which he treats of external diseases, among them cancerous tumors, for the treatment of which he repeats Galen's precepts, particularly the advice that all operations are to be preceded by a free purgation of the black bile. After Paul came little of any value. Nonus and Mercurius in the tenth century were absolute compilers, and Myrepsos, another of the same class, was dubbed by his contemporaries "the perfumer," polypharmacy being his strong point. His book on medicine is an alphabetical breviary, divided into 48 chapters, containing some 300 senseless prescriptions with pathetic appeals to God and Christ. His treatment of cancer is included under the head of "aromatics and specifics for the cure of lice and spots on the skin."

The Arabs were too firmly bound by the authority of Galen to make any advance. They added still more to the polypharmacy of their day, and not until the time of their later scholars was anything of value said regarding cancer. Avenzoar, however, who was really of Hebrew origin, showed a rather remarkable knowledge of pathology, as is illustrated in his discussion of cancer of the stomach. Some of their writers advised early extirpation of cancer and of all infected tissue. Albukasim remarks: "When cancer has become old and large you should have nothing to do with it. I have never been able to cure one, nor have I ever seen any one who has."

The notions of the Arabians were reflected in the Latin writings of the Middle Ages. William of Salicet says: "Cancer is a tedious disease—the more you interfere with it the worse it becomes." He frequently termed it *noli me tangere*. Lanfranchi says: "The general rule with cancer is that it can only be cured when it can be entirely removed, along with its roots." He had noticed the occurrence of cancer in badly healed wounds and advised their partial cauterization for the purpose of diagnosis. If the growth increased it was an original cancer. Guy de Chauliac endeavored to recognize the cause of cancer; his conclusion was: "Ulcerating cancer is caused by the existence of a former non-ulcerating cancer, or the irritation of chronic ulcers." He also held that if it be in a locality where it can be entirely removed it should be operated; if not, no attempt should be made save at palliation. He advised caustics for causing the death of suspicious tissue, and considered arsenious acid as desirable for this purpose. If the diseased tissue was thus completely destroyed the fact was shown later by the advent of a scar, and healthy appearance of the adjoining flesh.

But in time all operations fell into disrepute and cancer came to be regarded as practically incurable. The theorists of the Middle Ages with their immutable dogmas and superstitious reverence for Galen obstructed progress in every direction. Cancer was as before "an ulcer of horrid appearance, evil smelling, and presenting a hard, thick, discharging, everted border."

It was centuries before men could break away from the use of the red-hot knife. The celebrated Fabricius, he of Aquapendente, advised that glands be seized by forceps and cut away with a red-hot knife, or that an incision be made about the breast with a wooden or horn knife previously dipped in aqua fortis, and the glandular substance subsequently removed by the means of the finger and nails. But let us give the credit due to Fabricius for the suggestion to feed by a tube introduced through the nose into the stomach in cases of œsophageal contraction.

Paré, great man as he was, did not make the advance in this direction which might have been expected of him. He did not even do as well as did Fabricius Hildanus, who achieved the title of a noted operator because he operated with the knife, ligated the vessels, and dissected with his fingers. He also cleaned out the axilla in breast cases and conducted many cases to recovery. Paré was in most respects a follower of Galen. Dyscrasia was the ghost that haunted

medical literature for centuries, and is not even yet quite forgotten. "Cancer is from black bile, said Galen;" . . . "cancer is the product of melancholie," falls like an echo from the lips of Paré, who described under the head of melancholic tumors true scirrhus, and other cancerous tumors corresponding to the cacoethes of Galen.

Paré distinguished four kinds of tumors due to black bile:

1. The hard scirrhus proper, which is accompanied by no pain, is not sensitive on pressure, and is caused by natural black bile.

2. The imperfect, rough, painless, stone-like scirrhus, which is caused by great chilling or disintegration of humors.

3. The cancerous scirrhus caused by the heating and corrupting of humors.

4. The scirrhus phlegmonides, which is caused by the mixing of the bile and the blood.

Paré's treatment for these various conditions included abstinence in all respects, the classic method of black bile purgation and the external use of counter-irritants, fumigations, mercurial plasters, goat dung, and many other more savory applications, beyond which ingenuity could scarcely go. Paré described the transition of cancer occultus into cancer apertus, i. e., non-ulcerating into ulcerating forms as clearly as any clinician could desire. The pain, irregularity of shape, tendency to hemorrhage, oozing discharge, infiltration, etc., he faithfully portrayed. On one of his pages he gave a picture of a large sea crab and says: "Also the cancer is brownish blue in color, and uncouth in shape, like the animal whose picture is appended." He realized that women are more subject to cancer than men, called attention to the frequency of infiltration and metastasis, did not decry operation, but reminded his readers of the 38th aphorism of Hippocrates, which counsels against operating upon deep-seated occult cancers or those of long standing, or those occurring in patients of feeble constitution. He advised the use of sweet milk to destroy the odor of cancerous discharge.

His operative methods comprised two distinct procedures, the excision of the tumor with a broad margin of healthy tissue, with compression of the neighboring vessels and vigorous use of the hot iron, or the elevation of the tumor by means of a thread passed through it, its extirpation by means of scissors, and lateral incisions when necessary for relief of tension.

Throughout the seventeenth century black bile continued to be regarded as the chief cause of cancer. Frere Côme set a good example to posterity when, after having purchased a secret nostrum, he made public its ingredients, which were about as follows:

Cinnabar, 2 parts.

Ashes of old burnt shoes, 3 parts.

Dragon's blood and white arsenic, each 12 parts.

This was applied in dry powder or in paste mixed with oil.

One of the earliest real departures made from the old tenets was that of Ledran, who in 1757 published a work in which he showed the purely local character of cancer in its beginning and then formulated the best methods of cauterization. He devoted considerable space to the discussion of tumors of the breast, of which many are curable, and expressed the opinion "that not all is cancer which has been taken for such." Soon after this came Louis' publication on fungous growths of the dura and diseases of the eyeball, including cancer of the eye. Still confusion of terms complicated every thing, and in Plenck's essay on skin diseases, published in 1776, he describes 18 sorts of tumors, including inflammatory tumors, pus tumors, gangrenous tumors, hard tumors, water tumors, blood tumors, etc. This reminds me very much of a hospital that I visited in Seville a few years ago, where one ward was reserved for "Dolores," all patients who were suffering from pain being sent there.

Richter describes two classes of tumors, inflammatory and non-inflammatory, placing cancer among the latter. His remarks are quite in accord with those of von Swieten, who describes them as bad smelling, easily bleeding, rodent, ulcerating growths, which are found on the lips, tongue and genitals. Scirrhus they described as a hard, painful tumor situated in an organ rich in glands and having a tendency to cancerous growths, and then admits that these growths may arise from cracks, excoriations, styes, etc. Even Richter could not get away from the old black bile, but he held that it could not arise from inflammation alone. He regarded dyscrasiæ as predisposing elements in causation of cancer. Along with his colleague, Schmucker, he denounced bitterly the use of corsets as the invention of "that accursed Pompadour."

While Hunter's contemporaries were playing with belladonna and rabbit skins and all sorts of quackery, Hunter himself was experimenting with the control of fixed tumors by means of compression, but by fixed tumors he meant inflammatory lesions, whose nourishment he was trying to reduce by pressure. Fischer and Desault were trying to accomplish the same thing in the case of rectal cancer by the use of rectal bougies. The writings of Munro threw operative treatment into such disrepute that the Amsterdam Guild of Physicians felt called upon to offer a prize of 100 ducats for a safe and practical method of curing cancer. As may be imagined numerous remedies were proposed, and now came into repute the wonderful properties of cicuta (water hemlock or cowbane) which ran about the same course in those days that cundurango did in ours. As a result of disappointment with all these remedies operative methods came back again into vogue. Cancer of the breast, lip and scrotum were generally operated upon. Finally Petit gave formal expression to insistence upon the necessity for the removal of swollen glands of the axilla in cases of cancer of the breast.

And next comes the French Revolution, which not only shook the nation to its very foundations, but was a new era in that the authority of the ancients was no longer revered. A cold materialism sought to derive everything from the inherent properties of matter. Mysteries were no longer tolerated. The doctors of Paris even went down to the halls of death and sought to find the seat and secret of life among the still bleeding heads of those who had been guillotined. It was in 1773 that Peyrilhe declared that to cure cancer, even

to define it, was extremely difficult, which bit of wisdom won for him the Dijon prize. Morgagni died in 1771; just thirty years later Bichat gave the final touches to his great work on Anatomy. During the winter of 1801 he himself made six hundred autopsies in the Hotel Dieu. Of this work Corvisart wrote to Napoleon that no one in so short a time had done so many things and done them so well. He was the first to distinguish between stroma and parenchyma in tumor tissues, although he ascribed a fallacious importance to connective tissue.

Bichat's spirit survived, although he died a most untimely death, for Laennec made a sharp distinction between carcinoma together with tubercle and melanotic and other growths, basing this upon their histological structure. Some of the writers of that day saw that about these cases which they regarded as infection, and have endeavored to trace its path in the blood vessels and thoracic duct.

In the same way we owe to Laennec our insight into the relation of cancer to the internal organs. He also pointed out that scirrhus is not merely a hard tumor, and a forerunner of cancer, but of itself a distinct form of connective tissue cancer, which he classed along with the encephaloid, melanoma and tubercle, among heterologous growths.

It was, perhaps, Lobstein who first divided tumors into the homologous and heterologous or heteroplastic. He held that the latter forms arise from some form of lymph that has been introduced into an organ from an outside source. This lymph was compared by Lobstein to Hunter's wound and infiltration lymph agrees entirely with the blastema and exudate of Rokitansky and even later authors, and is either benign or malign, the latter giving rise to cancer. By the efforts of the school to which Lobstein belonged, including such men as Andral and Cruveilhier, Billiard and Velpeau, the differential diagnosis of tumors of the breast was greatly advanced, while such men as Astley Cooper in England, and Walther in Germany, were quite won over to these views.

After this the French rather retired from their advanced position, and their place came to be more occupied by German investigators. Stieglitz, writing in 1840, made this sad confession concerning his German colleagues: "German medicine is so far degraded and spiritless that any stimulus whatsoever that pushes it forward in a new road is sure to be of benefit, even though the path be beset with errors and perversities." Soon after this, however, all Germany began to move forward and scores of names are inscribed in imperishable characters in its history of medicine for the past half century. The theory of cancer profited by this forward motion and soon appeared in new dress. In the beginning of the third decade microscopical diagnosis was still a *pium desiderium*. Johannes Müller, after years of work, described six kinds of operable tumors, and seven kinds of carcinoma, which could not be cured by extirpation. Our knowledge was materially advanced by the researches of Schleiden and Schwann into animal and vegetable cells, by which many other things were to be reconciled. The allusions of Müller, in his third edition, 1838, to the more delicate structures of pathological growths called forth numerous contributions of a similar character from other writers. Moreover, he held that cancer formations do not arise from primitive tissue by degeneration but are produced by new cell formation, deposited as a specific element of disease in the normal connective tissue of the organ. He found also in this statement an explanation for the general infection certain later to pervade the whole system. Translated into the thought of to-day the most advanced of us would scarcely go beyond a similar doctrine. Müller is believed to have been the first to demonstrate the presence of nucleated epithelium in cancer. Naturally, with such views, Müller discarded all distinction between homologous and heterologous growths. This was taken up by Henle in 1839 and by Vogel in 1842, and an effort was made to prove that each growth is really a variation from normal growth due to defective or to active individual mother cells. About this time also began the attempt to discover specific cancer cells with the microscope, whose significance would be of greatest importance in diagnosis. This effort was carried altogether too far, since some enthusiasts denied the accuracy of all diagnoses where such cells were not found.

In 1847 great mischief was wrought by the introduction of the term cancroid by Bennett. This was to be the term by which all growths were to be known where the specific cancer cell could not be found. Then Virchow and Forster, as well as Lebert in 1850, limited the term cancroid to diseased tissue which presented alveoli with epithelial collections. Therewith epithelial cancer became the cancer par excellence, and many tumors took the name of sarcoma which hitherto were considered carcinoma. In 1852 Hanover introduced the term epithelioma, and Robin and Bidder described cylinder-epithelium cancer. By this time confusion in terminology was almost complete, and now for several years the epithelial cell, in epithelial cancer, was regarded as arising independently of pre-existing epithelium from connected tissue corpuscles. It was apparently von Bruns who, in 1847, first emphasized the rôle of the lymphatics in spreading this disease. Even in 1856 the condition was still regarded as uncertain and was the cause of many controversies.

J. Müller had already reported upon the spores given off by the body humors in cases of carcinoma, and it had been frequently noticed that in cases of melanotic cancer these were heavily charged with pigment. It was not long now before pathologists were divided as between those who held that primary cancer becomes constitutional by a general infection through the blood vessels, by means of a blastema or virus of some sort (theory of infection) and those who regarded the constitutional effects as due to the transmission of epithelial constituents and debris (theory of transplantation). Others yet saw in primary carcinoma only a local expression of a general carcinosis already acquired. The rest of the history of cancer is certainly well known to you and it is scarcely necessary to attempt to bring it down beyond the pioneer experiments of Waldeyer and Volkmann's early researches. It was through these studies that some sort of order

was finally restored, and that ideas which presented an indescribable jumble were more or less simplified.

Here I think I may venture to leave the subject as being rather too recent to justify discussion before a club devoted to the history of medicine, since the rest of it is almost within the personal recollection of those who may hear or read this paper.

The old claim of Peyrilhe that to cure cancer, even to define it, is most difficult, has been proven amply true. Even so rough an epitome of the history of the subject as these few pages afford will amply substantiate the statement that I have often made—that the problem of cancer stands before us still as the pathological mystery of the ages.

Because of its importance, as well as because history of the past makes progress easier in the future, I have ventured again to discuss the general subject of cancer in this city, and at this time.

GOVERNOR JOHN WINTHROP, JR., OF CONNECTICUT, AS A PHYSICIAN.*

By Walter R. Steiner, A. M., M. D.,

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The character of John Winthrop, Jr., is one of the most fascinating in the colonial history of New England. His "qualities of human excellence were mingled in such happy proportions that, while he always wore the air of contentment, no enterprise in which he engaged seemed too lofty for his powers. Even as a child he had been the pride of his father's house; he had received the best instruction which Cambridge and Dublin could afford, and had perfected his education by visiting, in part at least, in the public service, not Holland and France only in the days of Prince Maurice and Richelieu, but Venice and Constantinople. From boyhood his manners had been spotless, and the purity of his soul added lustre and beauty to the gifts of nature and industry; as he travelled through Europe he sought the society of men eminent for learning. Returning to England in the bloom of life, with the fairest promise of preferment, he preferred to follow his father to the New World, regarding 'diversities of countries but as so many inns,' alike conducting 'to the journey's end.'"

"The New World was full of his praises; Puritans and Quakers and the freemen of Rhode Island were alike his eulogists; the Dutch at New York had confidence in his integrity. In history he appears by unanimous consent, from early life, without a blemish; and it is the beautiful testimony of his own father that 'God gave him favor in the eyes of all with whom he had to do.'"[1]

But it is not only Bancroft who thus eulogizes him. The historians of Connecticut, Trumbull, Hollister and Johnston, also sound his praises. Trumbull calls him "one of the most distinguished characters in New England," and says "he rendered many important services to the colony, was exceedingly beloved in life, and died greatly and universally lamented."[2]

Winthrop followed his father to this country in 1631 and was shortly thereafter made an assistant in the Massachusetts Colony.[3] A year later he led a company of twelve to Agawam (now Ipswich), where a settlement was made.[4] In about a year he returned to England and received a commission to be Governor of the River Connecticut for one year.[5] On coming back to America he built a fort at Saybrook, Connecticut, and resided there part of that time.[6] Then, making no effort to have the commission renewed, he returned to Ipswich and became one of the prudential men of the town. Subsequently he moved to Salem, established some salt works there, made another trip to England, and finally, receiving Fisher's Island as a grant from the General Court of Massachusetts,[7] went there in the fall of 1646. In the spring of the following year he removed to Pequot (now New London), but, after a residence of eight years, moved to New Haven. From here he was called to dwell in Hartford on being elected Governor of Connecticut in 1657. He had previously (September 9, 1647) been given a commission to execute justice in his town (Pequot) "according to our laws and the rule of righteousness," and in May, 1651, was elected an Assistant of Connecticut. He served as Governor one year, then became Deputy Governor on account of a law which prevented his re-election. This law being repealed the next year, he served continuously as Governor from 1659 till his death in 1676, although in 1667,[8] 1670[9] and 1675[10] he requested to be relieved of this office.

From his youth he was devoted to scientific studies and was an omnivorous reader of books. Alchemy greatly interested him and among his correspondents were numbered Dr.

*Read in part before the Johns Hopkins Hospital Historical Club, May 11, 1903.

[1] Bancroft, Hist. of the U. S., Boston, 1879, i, pp. 420-421.

[2] Trumbull, Hist. of Conn., New London, Edition of 1898, i, p. 290.

[3] Winthrop, Hist. of New England, Boston, Edition of 1853, p. 76.

[4] Winthrop, op. cit., p. 100.

[5] Winthrop, op. cit., p. 170.

[6] Water's Sketch of John Winthrop, The Younger, 1900, pp. 17-18. This work has been largely used in the following account of Winthrop's life.

[7] This grant was subsequently confirmed by both Connecticut and New York.

[8] V Mass. Hist. Coll., viii, p. 120.

[9] V Mass. Hist. Coll., viii, p. 137.

[10] V Mass. Hist. Coll., viii, pp. 169-170.

Robert Child, Sir Kenelm Digby, George Storkey and Jonathan Brewster, all of whom had like ties. He was also much attached to astronomy and with his telescope, which was "but a tube of 3 foote & a half with a concave ey-glasse," he was able to see five satellites of Jupiter and make other celestial observations.[11] He seemed to enjoy especially the association with scientific men. In 1661, when he went to England for a third time, he arrived not long after the Royal Society for Improving Useful Knowledge was organized.[12] On December 11 of that year he was proposed for membership by William Brereton, afterwards Lord Brereton, and was admitted January 1, 1662.[13] During his stay in England, which continued till the early summer of 1663, he took an active part in the society's proceedings, read a number of papers on a great variety of subjects, and exhibited many curious things.[14]



John Winthrop

He came naturally by his liking for medicine, as his father had no mean knowledge of this science. In a letter his father wrote, on the occasion of his son's illness at Ipswich, he speaks of drugs and remedies which show him to be well acquainted with them.[15] This bent toward medicine existed in other members of the family also, for we learn Winthrop's brother Henry's widow "was much imployed in her surgurye and hath very good successe,"[16] and his son Wait and grandson John had both a laudable knowledge of medicine for their times.

At this period in the medical history of New England the offices of clergyman and physician were frequently associated in one individual—instances of what Cotton Mather has called "the Angelical Conjunction,"[17] the cure of body combined with the cure of soul. This association may largely have been due to the survival of the custom of the dark ages when the priests were considered the repositories of learning and held both of these offices. There is, however, an additional reason in the fact that medicine alone was not very profitable at this time, so we find some turning also to divinity, as Giles Firmin, who "previously did make and read upon the one Anatomy in the countrey very well."[18] In a letter still preserved he says: "I am strongly sett upon to studye divinitie: my studies else must be lost, for physick is but a meene help."[19]

"The scarcity of physicians in the Colonies and Winthrop's willingness to give advice free of charge—so far as his studies enabled him to do so—caused him to be much consulted."[20] Connecticut, Massachusetts and Rhode Island were the territories in which his patients mostly lived. They were frequently sent to him, generally at Pequot or Hartford, but at times he would come to see them in consultation with the village doctor, or otherwise, when they were too sick to be moved. Some were also treated by him by letter, without personal inspection. Cotton Mather says: "Wherever he came, still the Diseased flocked about him, as if the Healing Angel of Bethesda had appeared in the place."[21]

From his published papers, which consist mostly of letters addressed to him, I have been able to glean something relating to his career as a physician. In all I have collected over one hundred medical references.

His first patient appears to have been his father, who in some way had injured his finger. On April 11, 1628, Winthrop writes his father that he is sending some yellow and black plasters which were given him by a woman "that is very skilfull and much sought unto for

[11] V Mass. Hist. Coll., viii, p. 93. He was distrustful of having seen five satellites as Galileo and others had only observed four.

[12] It was first organized in 1660 but was not incorporated until two years later. Birch, Hist. of the Royal Soc., p. 67.

[13] Birch, op. cit., p. 68.

[14] Some of his papers during this period were on strange tides, the refining of gold, the making of pitch, tar and potashes, the building of ships in North America, and the brewing of beer from maize bread. Among the things he exhibited were a self-feeding lamp, of his own invention, malleable mineral lead, piece of a rock of granite, bluish grains of corn grown on the West Indies, and the tail of a rattlesnake.

[15] R. C. Winthrop, Life and Letters of John Winthrop, Boston, 1867, ii, pp. 365-366. In 1634, Dr. Stafford of London sent over an interesting collection of recipes, probably for John Winthrop, although they may have been intended for John, Jr. (See Holmes, Mass. Hist. Soc. Proc., 1862, pp. 379-399). The venerable Cotton (Magnalia, Hartford, edition of 1853, i, p. 131) says that the elder Winthrop had been a "Help for our Bodies by Physick, for our Estates by Law."

[16] R. C. Winthrop, op. cit., ii, p. 76.

[17] Mather, Magnalia, Hartford, edition of 1853, i, p. 493.

[18] III Mass. Hist. Coll., iv, p. 57.

[19] Hutchinson, Coll. of Papers, Boston, 1769, p. 169.

[20] Waters, op. cit., p. 47.

[21] Mather, op. cit., p. 159.

these things." Directions for their use accompany them." At the end of four days his father says: "I prayse God my finger is well amended, my surgeon did his parte well, and stayde the gangrene and tooke out the mortified fleshe, but because your love and peines should not be lost I have betaken myselfe wholly to your plaister wch the Surgeon likes well enough; & I prayse God it goeth well forward." [23] Some years later, in 1637, Winthrop's wife seems to have swallowed some pins. We do not know what means were employed to relieve her, but his father writes him a letter expressing great gratification that the wife had been delivered from so great a danger. He adds: "I hope it will teach my daughter and other women to take heed of putting pins in the mouth, which was never seasonable to be fed with such morsels." [24]

Besides these references we find many others which show the esteem in which his family held him for his medical knowledge. Winthrop's father-in-law, Hugh Peters, writes from Salem, saying: "My head is not well, nor any part at present, for I cannot get sleepe. I would you should send mee word what you will doe therein but rather come over" (from Ipswich).[25] He later speaks of his old malady of the "spleene" and says: "I never had hart or tyme to attend any cure, that I now give my life gone: & shall not live my parts I feare." [26] How little did he then know of the truth he was telling, for in eleven years he was executed as a regicide, at Charing Cross, on October 16, 1660! Winthrop's brother-in-law, Samuel Symonds, was a prominent man in Ipswich, and finally became Deputy Governor. In 1647 he states that his wife's indigestion is better and adds: "Good wine (as you say) is the best cordiall for her." [27] In a later letter he mentions his daughter having received some physick from Winthrop and being benefited by it.[28]

Eight years prior to this last communication, in 1641, Winthrop's aunt, Lucy Downing, from London, tells him she has "experimented the crocus this 2 nights, and found much though not a totall fredom of payne thereby." [29] Other letters follow this one about her various ailments. One written January 17, 1661, possesses some interest and causes us to wonder what she really had. She says: "I was taken with a veri sore paine one my leaft side wich at betwickst my short ribs and my buckell boone; and the paine being so sharpe, it was feared to have bene plurisi, but wen the dockter came he said it was not a plurisi but he judge it to be the stonne in the kidney, and thereupon did apli mani thing both inward and outward to remove the paine; the extremiti there of did put me into a very feaverish condishion, and to or thre fits of a fever, and then i was pritti well recovered; but return by a little could, but I relapsed in to another of those fits, and then i tried hot brikes to my side, and bages of fried oats, and up on the use of them i found the paine did much mittigate, and then i sent to the dockter, and he sent me a plaister wich I found, the same night i laide it on, it did much dispers the paine all aboute my bodi, and the neckst morning i found my seulf much better than formerli, and both my stomak and by weast are much better then of aweake before, but am still verri tender, and forst to kepe my chamber; but I have veri good hopes that the plaister may be a means to prevent such extremity for the futurr, and the dockter now thinkes it was some other trouble and not the stone." She forbare sending for Winthrop as she got some ease and hopes of recovery.[30]

Two years before Winthrop's death she was still living, although well on in years. She then mentions her increasing deafness, states that she had consulted two doctors for it and that they both agreed "the more she did tamper with her ears the worse it might be for her." She is "not willing consequently to a further hazerd of her ears and her mony allso for nothing." [31] On another occasion she speaks of her son, George Downing, "who tooke cold by water, his urine was wholly obstructed for 60 houres, wch put him into soe highe fever, that his Doctours did all despaire of his life. His Majesty sent him two of his Doctors; at last they all agreed to put him into a bath, wch it pleasing God to blesse, by degrees, it did give him some ease." [32]

Winthrop's niece, Hannah Gallup, writes to him on two occasions. At one time she wishes a litle phisicke and some directions for a "disease much like the fluxe." [33] In the other letter he is thanked for the "physik and other kindnesses." [34] Stephen and Samuel, Winthrop's brothers, also occasionally write to him about matters medical. The former, who served in Cromwell's army and Parliament, informs Winthrop, August 2, 1653, that he has been "this two years extreamly troubled wth the Zeatica, & am just now goeing to the Bath to see if yt may remedy it. My much lying in ye wet feilds uppon the ground hath brought it uppon me, as it hath uppon many others." [35]

Wait, Winthrop's younger son, frequently writes to him on medical topics and often he gets his advice as to treatment. In 1671, he wishes some directions for "convultion fitts in children, they being often troubled with them here (Boston); also for Mrs. Mary Maning for her old distemper, which you have given her something for formerly. She has bin very bad a prety while, voyding much blood, and the fundament falling downe, yet very costive. Likewise about a poore woman that is excessive bigg like a barrill notwithstanding she has bin delivered of a living child about seven or eight weekes. She complaines much of wind runing about

[22] V Mass. Hist. Coll., viii, p. 7, and R. C. Winthrop, op. cit., ii, p. 251.
[23] R. C. Winthrop, op. cit., ii, p. 258.
[24] R. C. Winthrop, op. cit., ii, pp. 217-218.
[25] IV Mass. Hist. Coll., vi, p. 97.
[26] IV Mass. Hist. Coll., vi, p. 112.
[27] IV Mass. Hist. Coll., vii, p. 127.
[28] IV Mass. Hist. Coll., vii, p. 131.
[29] V Mass. Hist. Coll., i, p. 30.
[30] It is well to state that she employed an amanuensis, so we must not blame the old lady for this spelling. V Mass. Hist. Coll., i, pp 54-55.
[31] V Mass. Hist. Coll., i, p. 61.
[32] V Mass. Hist. Coll., i, p. 59.
[33] V Mass. Hist. Coll., i, p. 98.
[34] V Mass. Hist. Coll., i, pp. 104-105.
[35] V Mass. Hist. Coll., viii, p. 214.

her, and is sometimes in grate paine. Her thighes and legs weare as bigg as a boy's midle, but thay are much fallen. Much water has come from her of late, besids urin. She semes to be something better, and her stomack, which was quite gon, begins to com to her. The midwife thinkes there is neither dead child nor mola within her." [36] On other occasions Wait buys various medicines in Boston for his father such as opium, jalap, "vitriolum album," ivory, and aloes.[37] Once Wait wishes his father to send some black powder to him "if ther be opertunity, and you have any quantitye made. I am almost out, and have not convenyence to make any presently." [38]

But aside from attending to his family's ailments he had many professional obligations to perform as the most prominent men of the colonies, as we shall see, consulted him frequently in cases of sickness. His duty to a patient caused him to forego, at one time, the pleasure of meeting Francis Lovelace, the Governor of New York, at Milford. He was obliged to express his regrets for "he was ingaged to a deare friend not long before, who was at the very Agony of death (as was feared by all then present there) not to be absent till an apparent recovery, wch then was doubtfull, but now (god be praised) is in a good measure attained, but there were reasons to think it might not have beene so, if I had been fro home." [39]

Elder Goodwin of Cambridge, Hartford, Hadley and Farmington thanks him for attending his wife and child and declares success crowned his endeavors in regard to the treatment of the former and wishes as "the water she used is all spent," that "the ingreedients & direction how to use it" be sent them; "for we are very loath to breake ofe the use of such meanes as God hath been pleased to make so usfull to us in this case." [40] "His daughter was afflicted with the palsy and did not seem to be benefitted by the treatment. She was also with child. In a subsequent letter we learn that the water was for Mrs. Goodwin "to wash her leg with all" and more powder was desired to make it up "for she fyndeth more releife & ease of her greife by that meanes than by any other she hath formerly had the use of." The daughter does not seem to have improved.[41] He says, at another time, "my wife suspecteth that she (the daughter) is breeding child, only is not certain." [42]

John Higginson, then assistant to Henry Whitfield, the pastor at Guilford, Conn., writes a most earnest letter to Winthrop, at Pequot, in 1654 or 1655, begging him to come and see his wife. Higginson does not say what her sickness, was but declares "the case is such as cannot be judged without ocular inspection." He calls it "a very sad affliction, she being in a very dangerous case as Mr. Rosseter (the village doctor) & all our neighbours here doe apprehend." He hopes that Winthrop's "counsell & help, together with Mr. Rosseter" may be the means of preserving her life, "if so it pleas the Lord." [43]

John Mason, rendered famous by the Pequot War and subsequently Major General, Commander-in-Chief of the military forces of Connecticut and for eight years Deputy Governor, writes several letters expressing appreciation for physick and services rendered to his wife who "as yet remaineth ill, yet sometimes a little reviveing, with the addition of somewhat more strength." [44]

Thomas Mayhew, Governor of Martha's Vineyard and Nantucket, as well as preacher to the Indians there, though bowed down by over three score and ten years, cannot refrain from rendering his thanks for Winthrop's "readiness in sending that powder for my grandchild together with advice." [45] I will speak of this again in referring to Winthrop's sovereign remedy, Rubila. Mayhew, agreeing with Higginson as to the value of ocular inspection, wishes to know if Winthrop is willing "shee should com to Conectacute, where shee may be neare yow, and also the sight of hir may much more informe your judgment touching her disease." Subsequently Mayhew mentions an attack he had of what may have been appendicitis. He states the "paine I had seised one me in the morning betyme, uppon the right syde; the paine was not so broade as the palme of my hand. It was like to take me of the stage, but it went away in my sleepe that night; when I awoke, I was altogether free of that paine and of other sore paine which came uppon me in useing menes by a glyster to free my sellfe of that." [46] His last letter, written less than a year before Winthrop's death, tells us that one of his grand-daughters had used the physick sent with success but the little ones had not taken any [47] and we wonder if Rubila was not the remedy employed.

Captain John Underhill, of Long Island, heretical, eccentric and illiterate yet firmly convinced that God has made Winthrop "an instrument of the gud of mani diseased," desires relief for his wife "whom dayli continnuse in gret payne, resefing last yere a payne in her back with alift of a wayti stone and dayli increses her payne, and desense in to her left hip, so that shee can not torn her in bed, no gooe up rit in the daye." [48] And again he wishes Winthrop to help "a gud godli woman, and diere frend of my wife" whose distemper "is as a shoutting agew, pricking in her left side, asending into her tempels, and tieth, hed and jase, and takese her sometimse too dayse together and hase had it niere 12 months, with such extremiti as shee can not rest nigh[t] nor daye, and takes her at aell sesonse, night and daye, shiftting his course as an ago." He also hopes Winthrop will send his wife a "littil whit vitterall." [49]

[36] V Mass. Hist. Coll., viii, p. 385.
[37] V Mass. Hist. Coll., viii, p. 146.
[38] V Mass. Hist. Coll., viii, pp. 397-398.
[39] III Mass. Hist. Coll., x, p. 81.
[40] IV Mass. Hist. Coll., vii, p. 46.
[41] IV Mass. Hist. Coll., vii, p. 47.
[42] IV Mass. Hist. Coll., vii, p. 49.
[43] IV Mass. Hist. Coll., vii, p. 400.
[44] IV Mass. Hist. Coll., vii, p. 416.
[45] IV Mass. Hist. Coll., vii, p. 39.
[46] IV Mass. Hist. Coll., vii, p. 40.
[47] IV Mass. Hist. Coll., vii, p. 43.
[48] IV Mass. Hist. Coll., vii, pp. 182-183.
[49] IV Mass. Hist. Coll., vii. pp. 188-189.

Roger Williams, the ardent Quaker and founder of Rhode Island, was long one of Winthrop's correspondents. In 1649 he writes about his daughter, aged seventeen, who had "taken much physick and bene let blood but yet no change, she is advised by some to the Bay: I pray advize me to whom you judge fittest to addresse unto of the Bayes Phycitians."[50] At another time he speaks of his son troubled "with a spice of an epilepsie"; "We used some remedies," he says, "but it hath pleased God by his taking of tobacco perfectly (as we hope) to cure him."[51] Mention of Williams will again be made when we discuss Rubila.

Winthrop's "loveing freind," George Hethcote, from far off Barbadoes asks for something in 1669 "to stop the groweth of consumption." His mother had previously told him he had it, but he put, unwisely in this case, more confidence in his doctor, who informed him to the contrary. He goes on to add "I am much troubled with a thin sharp salt youmer that settles uppon me longes and causes me to spitt much and sume time cough but seldom—that powder I had of the for the spittinge did me much good." He wishes, consequently help in medicine and diet so that "the cause and ground of the consumption may be taken away if the Lord see good."[52] Possibly also about this time John Tinker appealed to Winthrop on behalf of his servant who was injured "by reason of a little stike run into his head through the hole of his eare." "We know not what to do," he declares, "I intreat your worshipps advice."[53]

Samuel Gorton of Rhode Island, "turbulent in disposition" and so constituted that "every community where in he cast his lot was anxious to get rid of him" but now tamed by his four score and two years, writes to Winthrop on August 11, 1674, of his "sore infirmitie and distemper which hath held him now almost a whole moneth of dayes." It was the "pain of stone in the bladder or stranguarion, or both." He says: "My provocation to make urine is painfull, and so is the act, and though I strive, yet but small quantitie issueth from me, which in short time reneweth in like operation; but in the night season, when I sleepe, or am upon any slumber, it doth issue from me insensibly, and I thinke more abundantly; and when I awake and am provoked therto, it is as aforesaid; insomuch that my disease is uncooth, being for and against. I strive after power expulsive, and also retaintive, but neither the one nor the other answers the desires and apointments of nature."[54] A month later, with a heart full of thanksgiving, he pours forth his rejoicings to Winthrop in a letter which takes up twenty-five octavo printed pages. The "cordiall and soveraighne powders" Winthrop had sent had so done their work he finds his body "to be little differing from that which it was, before the distemper seized" upon him.[55] Also another "infirmitie" which was a "benummednesse or like the crampe" is taken away. He wonders consequently "that a thing so little in quantity, so little in sent, so little in taste, and so little to sence in operation, should beget and bring forth such effects."

Edward Wigglesworth, a minister of the Gospel, thinking he strained himself when being hot he "tooke a lift" on a cold day in the winter, desires medical aid. He states some months after the accident "when I looked upyards being ready to fall backwards, and when I looked downward, to fall forward. And in my legs and feet benummedness, as if they were asleep by lying double under mee." Thinking it was the scurvy which he previously had, he neglected to use any means. As he grew worse the following autumn he used artificial baths, sixteen in all, and in the spring following "oiles, ointments plaisters" but all accomplished nothing. Finally a weakness affected his whole body so that he could "hardly move his neck a little." He greatly desired Winthrop to come to New Haven to see him.[56]

Two early Governors of Connecticut—Edward Hopkins and John Haynes—also need his services. Hopkins appeals to him to see if he can help his wife's condition. She was insane. Some "water" seems to have been sent which was given as directed but no "alteracion in her" was perceived.[57] Haynes has occasion many times to ask Winthrop's assistance on behalf of his wife. In 1649, he writes that his wife is yet in the land of the living but falls into her violent fits when she tries to sit up.[58] Some months later we hear that she "is yett alive, but this month or more was seldom free from her most violent fitts."[59] Shortly thereafter he wishes to send her down to Winthrop at Pequot but "this chimera seemes to obstruct." "For this ten weekes my wife has not hadd the course & custom of woemen uppon her, which formerly failed not, except with child." He wants to know if the medicine which has been prescribed may be safely given her in this condition.[60] Later he speaks of a "little alteracion of her fitts apearing, att times" and says he wants to send her down to Winthrop during the winter. If she could not come he would like to know if anything could be administered safely to her at such a distance.[61] A little later he states she is unable to come "for soe it is, what wee formerly conceited probable is now palpably manifest, she proves with child, and is now quick." He mentions also that she has "pain all over her, especially her right side: her water is very high coloured, with much weakness, only at present the burning is well abated." She has also a "short cough, breaths shorter, stuffed at the stomache, but rayses not ought." In a footnote he adds "my wife has paine alsoe on her left side, although the most is one the

[50] III Mass. Hist. Coll., ix, p. 288.
[51] III Mass. Hist. Coll., x, p. 28.
[52] III Mass. Hist. Coll., x, p. 76-77.
[53] III Mass. Hist. Coll., vii, p. 238.
[54] IV Mass. Hist. Coll., vii, p. 603.
[55] IV Mass. Hist. Coll., vii, pp. 504-631.
[56] III Mass. Hist. Coll., ix, pp. 296-297, and Bul. N. Y. Pub. Lib., N. Y., 1899, iii, pp. 395-396.
[57] IV Mass. Hist. Coll., vi, pp. 335-336.
[58] IV Mass. Hist. Coll., vi, p. 360.
[59] IV Mass. Hist. Coll., vii, p. 452.
[60] IV Mass. Hist. Coll., vii, p. 453.
[61] IV Mass. Hist. Coll., vii, p. 454.

right side, wher the incision was."[62] How much would we give to interpret what the operation was for! The remedies employed must have been somewhat effectual for we read her "violent fitts are but seldomm, her cough is abated, & herself able to sitt upp in a chaire at night for three or fower howres."[63] She fears however that the supply of the powder which is to prevent her fits will soon be done and craves a further supply of the same. A month later she continues to improve and new and fresh supplies of medicines are again asked for as the preventing phisicke is all spent as is all the rest almost, both drinke and powders.[64] She was also troubled with fainting fits and Haynes wishes to know "whether she might not take of red cowes milk as formerly she did of goates milke."[65] "A soare paine on her backe"[66] as well as other aches and ailments demand Winthrop's attention on other occasions. We imagine he must have grown weary sometimes in hearing and reading the long calendar of her complaints.

In New Haven Colony, Winthrop had as patients the families of a brilliant group of men—Eaton, Davenport and Leete. Theophilus Eaton, the first Governor of that Colony, was a pure and noble character. He was also a long suffering man by reason of his second wife who "seems to have been in the habit of venting a very ugly temper in the most outrageous language to the whole family, from her husband down to Anthony 'the neager.' For she slapped the face of 'old Mrs. Eaton' while the family were at dinner until the Governor was compelled to hold her hands; she pinched Mary, the governor's daughter by his first marriage, until she was black and blue and knocked her head against the dresser which made here nose bleed much; she slandered Mary, falsely impeaching her character, and in all points she seems to have been the type of the vulgar step-mother."[67] In Eaton's first letter he wishes Winthrop to come to New Haven from Pequot and sends a horse to him so that he could "advise, on arrival, for recovery of Davenport's health."[68] Again, thinking to send his daughter Hopkins in the "ffleete," he desires Winthrop's opinion as to the danger of a winter voyage.[69] He later states: "my wife with thankefulnes acknowledgeth the good she hath found by following your directions, but doth much desire your presence here, as soone as the season, & your occasions will permit, both in reference to my daughter Hopkins, and my daughter Hannah, who hath bin evercised these 4 or 5 dayes with vapours rising (as we conceive) out of her stomack into her head, hindering both her sleepe & appetite to meate, and apt to put her into fainting ffitts, whether from winde or the mother or from what other cause I cannot informe."[70] Hearkening unto this request, Winthrop went down to New Haven and prescribed some remdies. We read that "daughter Hopkins tooke the first potion of purging physick he left and hath kept her bed since and my wife is in some doubt whether she should give her any more of it till she have your advise."[71] In 1655, Eaton informs Winthrop of daughter Eaton's death and wishes him to come, if his family could spare him, to see her husband, who complained chiefly of a cold, a cough and a "paine in the reight side." Some bloody material had been vomited up on three or four occasions.[72] The last information we have of the family is when we are told "daughter Hopkins hath taken some of her physick and it wrought kindly."[73]

William Leete, also a Governor of that Colony and later of Connecticut, for some reason or other, did not desire to employ Rossiter (the village doctor). He consequently, much to Rossiter's disgust no doubt, consulted Winthrop on every necessary occasion. At one time he writes "my wife entreats some more of your phisick, although she feareth it to have very contrary operations in Mr. Rossiter's stomack"[74]—an instance that professional jealousy existed in those days.

Leete's family caused him much concern. In 1658 he writes "our youngest childe, about 9 weekes old, haveing ever since it was 3 or 4 dayes old, hath apeared full of red spots or pimples, somewhat like to measles, & seemed allwayes to be bigg, and to hang over on the eye browes & lids; but now of late the eye lidds have swelled & look very red, burneing exceedingly, & now at last they are so sweld up that the sight is utterly closed in, that he could not see, nor for severall dayes, nor yet doth, & the verges of the lids, where they close, have a white seame, like the white heads of wheales, wherein is matter: it is somewhat extraordinary, such as none of our woemen can tell that they have ever seene the like."[75] This child, Peregrine by name, was doubtless the cause of many an anxious moment to his parents. Leete later writes of "his starting, & sometimes almost strangling ffitts, like convulsions, which have more frequently afflicted the infant of late than formerly." We are apt to conceive it probable he says to proceed from more than ordinary painful breeding teeth.[76] His eyes seem to be somewhat better from the use of a "glasse of eye watter" which was also used on other of the children so that "a little further recruit" of the same was desired. Peregrine did not, however, monopolize all the family troubles for his sister, Graciana, was a weakly puny thing and gathered strength but very little. Winthrop's treatment seems to have caused an improvement for shortly thereafter she began "to slide

[62] IV Mass. Hist. Coll., vii, p. 455.
[63] IV Mass. Hist. Coll., vii, p. 456.
[64] IV Mass. Hist. Coll., vii, p. 459.
[65] IV Mass. Hist. Coll., vii, p. 460.
[66] IV Mass. Hist. Coll., vii, p. 461.
[67] Johnston Hist. of Conn., Boston, 1887, p. 159.
[68] IV Mass. Hist. Coll., vii, p. 469.
[69] IV Mass. Hist. Coll., vii, p. 471.
[70] IV Mass. Hist. Coll., vii, p. 473.
[71] IV Mass. Hist. Coll., vii, p. 475.
[72] IV Mass. Hist. Coll., vii, p. 475. Samuel Eaton was the son here mentioned. After Gov. Haynes' death, he married his widow, of whose ailment we have previously spoken.
[73] IV Mass. Hist. Coll., vii, p. 476.
[74] IV Mass. Hist. Coll., vii, p. 548.
[75] IV Mass. Hist. Coll., vii, p. 539.
[76] IV Mass. Hist. Coll., vii, p. 542.

a chaire before her & walke after it, after her ffeeble manner." [77] She caused trouble, however, in the taking of her medicine and Leete asks for directions "to make her willing & apt to take it; for though it seemes very pleasant of itselfe, yet is she grown marvailous awkward and averse from takeing it in beer. Wherefore I would entreat you to prescribe to us the varyety of wayes in which it may be given soe effectually; wee doubt els it may doe much lesse good, being given by force onely." [78] Andrews' "starting fits" [79] as well as a "distemper which my son William's wife can best explain" [80] demand other letters to Winthrop. Leete also writes about a weak back which afflicted a neighbor's child.[81]

But John Davenport, the first pastor at New Haven, appears to have required Winthrop's services most. In all seventeen letters are to be found containing medical references, most of them are about his wife's prolonged illness but some concern himself. In 1653 he wishes to go to Pequot to confer with Winthrop over the state of his body. "My wife," he adds, "inclineth to our travayling with you to Boston, if you judge that a place and time fitt for me to enter into any course of physick." [82] Four years later Brother Herryman's eye caused Davenport much anxiety and he wrote much to Winthrop about it. He says the medicines sent gave some benefit "for it opened the liddes gradually by litle & litle, and gave him ease. But, upon the opening of his eyeliddes, they find that in the eyes, where the sight was, is a mattery substance which brother Peck thinckes flowed out of it (peradventure it is the chrystaline humor); he saith it is ragged, or like white ragges undissolved, which yet he thincks, may be easily dissolved; and from the ball of the eye groweth a carnous substance, which covereth the neather eye lid all over, and at the end of it, in the corner of the eye, by his nose, is a tumor of a pretty bignes. Hereby, his eye seemes to be as 2 eyes, to them that looke upon it; yet sister Herryman saith she can see his eye under that excrescence. The excrescence is red, & so is his eye. On the 5th day last he tooke the powder, which worked very well, but most upwards, which, sister thinckes, increased the swelling about his eye. Brother Peck thinckes that his eye hath no sense [in] it, nor can they yet say whether the sight is wholly lost, or not, till that white mattery substance be taken away which is before it." Herryman intended, until Winthrop's further directions came, "to put a little sugar candie into it for the present, which, he saith, may doe some good, & no hurt." Before this letter was sealed sister Herryman came into Davenport's study with the good news that her husband "could stirre his eye yesterday a litle, & this day more, & that the excrescence from the ball of his eye (which she likeneth to a wheate straw, & toucheth the underlid), lookes a litle paler then it did, that the eye lid growes more plyable, & he can open it a litle himselfe. That tumor by the side of his nose, she saith, is about the bignes of a litle pea. The white that covers the black & darke colour of his eye is as bigg as a penny, & in the middest of that is that ragged matter I wrote of before. Brother Herryman thinckes that he pricked his eye with a bodkin, & that might cause this ragged thing about his eye. Sister Herryman & he boath thinck that what you sent workes well; for he findes that he can stirr his eye, which before was as a thing dead & other good effects. He is alsoe at ease." [83]

From the account we have of her Davenport's wife must have been an intensely neurasthenic woman. In 1658 he states that she "hath bene, diverse times, this sumer, and stil is, valetudinarious, faint, thirsty, of litle appetite, and indisposed, sundry times, yet goes about and is between times better and cheerful, yet ordinarily, on the mornings, shee feeles a paine in the bottom of her back." [84] Later he speaks of her being "weake in her spirits and weake stomached." [85] On one occasion he adds in a postscript "My wife heares by one, in this Towne, that a Dr. of physic in England saith that conserve of Rue will hinder propagacon of children—She desires to understand your judgement concerning it." [86] For her various complaints Winthrop dosed her with Rubila (as I will mention later), "pilles" and other unknown medicines without marked beneficial effect. The last note we have of her is in 1667 when Davenport, finding her refractory in taking her remedies, writes in the depth of his despair to Winthrop, saying "my wife tooke out halfe of one of the papers, but could not beare the taste of it, and is discouraged from taking any more. I perceive that some speech from yourselfe would best satisfie her, but if God's providence puttes a barr in the way, we are called to submit thereunto." [87]

Davenport, himself, seems to have had a somewhat similar malady. At one time he states after a ride with the Governor my urine on returning home "grew so high coloured, that my wife thought it was bloody, and hath ever since continued very high coloured, and many times she observes a black settlement in it. I have been, for about a fourtnight, costive, though not wholly without stools, but once in 2 daies, at least, and of late once every day, I doe somewhat at the stoole—Degestio quidem pauca est, et cum difficultate quandoque etiam cum inani conatu egerendi quam tenissimum nuncupant medici. I am daily at least every morning, til I have breakfasted, troubled with a paine at the bottom of my belly, most usually on the left side, and at other times also after walking, yet my appetite and digestion are good, considering the season. For hot weather weakens, and almost prostrates my spirits, when it is extreme." [88]

[77] IV Mass. Hist. Coll., vii, p. 542.
[78] IV Mass. Hist. Coll., vii, p. 543.
[79] IV Mass. Hist. Coll., vii, p. 546.
[80] IV Mass. Hist. Coll., vii, p. 574.
[81] IV Mass. Hist. Coll., vii, p. 563.
[82] III Mass. Hist. Coll., ix, pp. 294-295.
[83] IV Mass. Hist. Coll., vii. pp. 490-492.
[84] III Mass. Hist. Coll., x, p. 21.
[85] III Mass. Hist. Coll., x, p. 36.
[86] III Mass. Hist. Coll., x, p. 46.
[87] IV Mass. Hist. Coll., vii, p. 531.
[88] III Mass. Hist. Coll., x, p. 35.

After a course of treatment "by the mercy of God," he declares, "my body is about to returne to its former state, the paine being much abated, and that difficulty and frequent *irritus conatus egerendi* ceasing in a good degree. I am now content to let nature acte of itselfe in hope that by God's blessing upon suitable diet, I shall be well againe, in due time."[89]

In addition to all these above named patients mention should also be made of a probable one, "Mrs. John Megs" of Guilford. In 1673, Joseph Eliot, Higginson's successor at Guilford, writes "John Megs" a letter of introduction to Winthrop. In it he asks aid for Meg's wife who has "a gentle beginning of fits of flatus hypocondriacus yt stir upon greife yet without violence for the present."[90]

The best known remedy Winthrop put up and dispensed was one of his own concoction, Rubila, whose method of making was handed down to his son Wait and grandson John. It is to the latter that Increase Mather wrote on June 23, 1718, desiring a considerable quantity of Rubila sent to Madam Winthrop, his mother, "for the relief of such as the Lord shall please to bless it for y^ir health."[91] But its composition was unknown from then on till Dr. Oliver Wendell Holmes deciphered a manuscript collection of the medical cases treated by Governor Winthrop from 1657-1669 and came across the following prescription. It was written, as most of them, in symbols which Holmes thus interpreted:

"Four grains of (diaphoretic) antimony with twenty grains of nitre with a little salt of tin making rubila." Perhaps, Holmes states, something was added to redden the powder as he constantly speaks of rubifying or viridating his prescriptions, a very common practice of prescribing when their powders took a little too much like plain sugar.[92]

Unfortunately it would seem from letters subsequently published that something was purposely omitted. Winthrop himself sends some of the powder to his son Wait, and remarks that it is not ground enough,[93] and Wait, on other occasions, speaks of some, of his own manufacture, which was not enough ground,[94] half ground,[95] or grossly beaten.[96] He says also "it is best to make it before the weather be hot"[97] and at another time, "the dog dayes will not be so good to medle with rubila in, so it must be deferred at present."[98]

This remedy appears to have been a cure-all. It was given as an antidote in case of fevers, as a preventative against fits, for "sweild legs," for colds, for colics, for agues—in fact for any ailment. In a letter to his brother, Fitz John, Wait states that he knows "no better antidote in feavers then the black powder, niter, snakeweed, lignum vitae, white cordiall powder, unicorn's horn, all of which you know the use of."

"Mix snakeweed and lig. vitae with niter to take in the morning; mix fower graines apeice of corall, oculi cancrorum, and ivory, to be taken at any time; thre or 4 graines of unicorne's horn mixt with the black powder at night; but remember that rubila be taken at the beginning of any illness."[99] Again, discussing Fitz John's distemper, he says that Rubila if taken "at the very beginning of it, must needs abate much of the maligntye of it, and so render it lesse dangerous."[100]

Many in different parts of New England kept a store of Rubila constantly in the house, from which the town was supplied whenever necessity arose. When the powder was exhausted more was written for. In 1653, Deacon Child of Watertown writes "my wife would entreate you to send her a parcell of your physick, devided into portions for young and ould. She hath had may occasions to make use therof, to the help of many."[101] Nearly a year later he says his wife is very ill and "often wisheth she had a ption of yo^r phisick by wch she & other have found good, & and is psuaded should doe again had she off it."[102] Davenport and wife are, also, among those who received bountiful supplies of Rubila on several occasions for themselves, their sick neighbors, and friends. It was once desired by Mrs. Davenport for the good of the people that needed it, yet she says, "she had rather have bene without it, then you should get hurt by sitting up too late."[103] This seems to imply that Winthrop might have spent some time in the making of it or that he chose the night season as he could then prepare it in secrecy, without any interruption. Later Davenport's supply is wholly spent so that though some have desired it they turned away empty.[104] Roger Williams of Rhode Island "sick of a cold and feaver" asks that this powder might be sent with directions. If the ingredients be costly, he will thankfully account. He then adds "I have books that prescribe powders but yours is probatum in this Country."[105] Again he asks for more as his wife wants some for Mrs. Week's daughter of Warrick.[106]

Though Winthrop died in 1676, yet John Allyn of Hartford, long secretary of Connecticut, had not forgotten the benefits he had derived from taking this powder and writes in 1681 to the Governor's son, Wait, for "a small portion of rubila to ly by if your store would permit it."[107]

[89] IV Mass. Hist. Coll., vii, p. 517.
[90] Proc. Conn. Med. Soc., Bridgeport, 1892, p. 216.
[91] VI Mass. Hist. Coll., V, pp. 380-381.
[92] Holmes: Medical Essays, Boston, 1891, p. 335.
[93] V Mass. Hist. Coll., viii, p. 144.
[94] V Mass. Hist. Coll., viii, p. 419.
[95] V Mass. Hist. Coll., viii, p. 427.
[96] V Mass. Hist. Coll., viii, p. 420
[97] VI Mass. Hist. Coll., v, p. 342.
[98] VI Mass. Hist. Coll., v, pp. 69-70.
[99] V Mass. Hist. Coll., viii, p. 429.
[100] V Mass. Hist. Coll., viii, p. 437.
[101] V. Mass. Hist. Coll., i, p. 167.
[102] V Mass. Hist. Coll., i, pp. 167-168.
[103] IV Mass. Hist. Coll., vii, p. 510.
[104] IV Mass. Hist. Coll., vii, p. 516.
[105] III Mass. Hist. Coll., ix, p. 268.
[106] IV Mass. Hist. Coll., vi, p. 275.
[107] VI Mass. Hist. Coll., v, p. 9. John Winthrop, Jr., had previously been the family physician. At one time Winthrop writes to his son Wait, "Tell Mr: Allyn his wife hath a tertian ague w^ch began the day he went hence, & we hope the worst of it is over. I was w^th hir this morning, & hir fit was shorter and more moderate then former." (V Mass. Hist. Coll., viii, p. 144.)

Thinking, perhaps, that too little would be sent he then says: "I used to take 8 grains at a time." Richard Wharton of Boston, also, desired some for his cold "which he could not yet shake off and thought that a full supply of it would have saved him a great deal of blood wch he had been forced to part with."[108] And Governor Haynes when John Winthrop was alive writes, too, for working physick or powder which benefitted his wife as "it wrought very kindly alwaies both causing vomiting and purdginge."[109] Subsequently the usual dose was not effectual for we learn twice it hath not wrought at all.[110]

The powder seems to have been rather nauseous in its taste and many objected to take it. It may have been the powder William Leete asks directions about for Graciana his daughter as "she is grown marvailous awkward & averse from taking it in beer."[111] Thomas Mayhew wants some more for his daughter, we learn, as she is now willing (probably after much urgings and inducements) to take it.[112] With Winthrop's great-grandson, however, no trifling was permitted. We read in a pathetic letter to his son which Wait has left us: "Poor little Tome taken yesterday with great pain in his stomach, belly, and side, like a plurettick feaver; your mother and most of the house up with him all night.[113] He took rubila this morning, and hope he is better." This might mean though that little Tome resisted the taking of this nauseous drug till the morning when, worn out and tamed, he took his medicine, as he ought, like a little man.

When Mr. Stone was sick Davenport endeavored to persuade him to take this powder but did not find him "inclinable, though he was burthened in his stomach." In the same letter Davenport states that Governor Newman took once Rubila, "but finding himself sundrie times ready to faint away, hath not been willing to take it againe, nor his wife that he should, though we persuaded and encouraged him thereunto."[114] Small wonder, then, is it that Wait Winthrop states "for feverishness & restlesness" he has found "nothing help like rubila when there has been *strength* to bare it."[115]

The dose generally was one to two grains, but this amount was at times exceeded for John Allyn, we saw, used to take eight grains at a time[116] and Mrs. Davenport took once 6 graines of rubila, and had 3 vomits and one stoole" but "lookes better from it."[117] On one occasion it was advised to be given in a "pill don up with bread."[118] For "Ashbyes extreemely sweld leggs" Wait Winthrop writes "if he would be persuaded to take rubila in such a proportion as would not work with him tho the fever be not over and to take it every day for som time, it wold insensibly and by degrees take away both the swelling and every evill symptom; he may begin with a grain, or halfe a grain, and so increase halfe a grain every day till it begins to make him a little quamish, and then the next time decrease halfe a grain or a grain, and then keep to that proportion." This dose would be rather a "cordiall for him than weaken him." It may make him costive and to overcome this, a "spoonful or two or molasses alone, or mixt with a spoonful of oyle, would be as good as anything."[119]

With such a demand for this powder we are not surprised that Wait is obliged, on several occasions, to send for large supplies of some of its ingredients. At one time he asks for "fifty pounds of nitre and twenty pounds of good tartar free from dust."[120]

Besides Rubila Winthrop prescribed niter ("which he ordered in doses of twenty to thirty grains to adults and three grains to infants") iron, sulphur, calomel rhubarb, guaiacum, jalap, horse radish, the anodyne mithradate (a shot-gun prescription), coral in powder form, amber and electuary of millipedes. He also used elecampane, elder, wormwood and anise, as well as unicorn's horn.[121] In 1658 Davenport sends him "his owne unicornes horne" which Mrs. Davenport had kept safe for him since he sent it to Mrs. Eaton.[122] Another remedy he probably used was one later in his son's pharmacopœia. It was known as oculi cancrorum and was sent him by Sir Kenelm Digby, who thus describes its preparation.[123]

"Beate to subtile powder one ounce of crabbes eyes (in latin called Oculi Cancrorum), then putt upon it in a high glasse (because of the ebullition) foure ounces of strong wine-vinegar. It will instantly boyle up extremely; let it stand till all be quiett; then straine it through a fine linon, and of this liquor (wch will then tast like dead beere; without any sharpenesse) give two spoonefulls att a time to drinke, three times a day: and you shall see a strange effect in a weeke or two."

Although Winthrop treated agues yet I hope he did not employ the following remedy, also sent him by Digby who claims to have had "infallible successe" with it:

"Pare the patients nayles when the fitt is coming on; and put the paringes into a litle bagge of fine linon or sarsenet; and tye that about a live eeles neck, in a tubbe of water. The eele will dye, and the patient will recover. And if a dog or hog eate that eele, they will also dye."[124]

Winthrop's life, which was thus devoted so largely to the public weal in his capacities as statesman and physician, was brought to a close on April 5, 1676, but the good which he wrought is not forgotten and will be ever cherished, even by future generations.

[108] VI Mass. Hist. Coll., v, p. 16.
[109] IV Mass. Hist. Coll., vii, p: 460.
[110] IV Mass. Hist. Coll., vii, pp. 461 and 466.
[111] Mass. Hist. Coll., loc. cit.
[112] Mass. Hist. Coll., loc. cit.
[113] VI Mass. Hist. Coll., v, p. 342.
[114] III Mass. Hist. Coll., x, p. 43.
[115] VI Mass. Hist. Coll., v, p. 336.
[116] Mass. Hist. Coll., loc. cit.
[117] III Mass. Hist. Coll., x, p. 36.
[118] VI Mass. Hist. Coll., v, p. 121.
[119] IV Mass. Hist. Coll., v, p. 106.
[120] V Mass. Hist. Coll., viii, p. 513.
[121] Holmes, op. cit., pp. 332-333.
[122] III Mass. Hist. Coll., x, p. 20.
[123] III Mass. Hist. Coll., x, p. 17.
[124] Mass. Hist. Coll., loc. cit.

PNEUMOCOCCIC ARTHRITIS: REPORT OF THREE CASES.

By Campbell P. Howard, A. B., M. D.,

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That lobar pneumonia is an acute general infection, and not a purely local disease of the lungs, has long since been established beyond all dispute, and has been recognized as such in all modern text-books. Yet I think still further evidence may prove of interest, if not of value, to the medical world.

The first case reported below occurred in the service of Dr. Osler in the medical wards of the Johns Hopkins Hospital, and affords a good illustration of septicæmia from Fraenkel's pneumococcus without marked pulmonary involvement.

This is the first case that has occurred in the medical wards since the report of two cases by Cole in *American Medicine*, May, 1902, in spite of the fact that upwards of fifty cases of pneumonia have been under observation.

Case 1.—*Clinical Summary—Acute lobar pneumonia* (rt. mid-lobe), *ac. pericarditis* (7th day), *arthritis of right shoulder* (7th day), *ac. vegetative endocarditis* (8th day), *meningitis* (9th day), *arthritis of right ankle* (10th day), *death* (11th day).

W. A. H., æt. 42; male; German; Med. No. 15,749. Admitted June 2, 1903, on the fourth day of the disease. Complaining of "fever."

Family History.—Negative, except for death of one child from "spasms."

Personal History.—Weakly as a child; no definite diseases of childhood beyond some "brain trouble;" pleurisy twice in 1878; typhoid fever in 1901; no other acute infections.

Head: Slight deafness in right ear since childhood; no history of discharge.

Respiratory: Subject to colds; always more or less cough with whitish sputum; no hæmoptysis; frequent night sweats, drenching night gown.

Alimentary: Vomited occasionally during past year, irrespective of food; diarrhœa since May 1, 1903, with 4 to 5 water stools; never contained blood.

Genito-urinary: Micturates once or twice every night for years; œdema of ankles since 1902; denies lues and tripper; no history of secondaries.

Habits: Used alcohol to excess since youth, beer, whisky, etc.; does not use tobacco in any form.

Present Illness.—Since the last week of May, 1903, has been feeling out of sorts; general lassitude; anorexia. About May 30 had chilly sensation, but no definite rigor; fever and drenching sweats during the same night. Much cough with fairly profuse muco-purulent sputum, never blood-tinged. Fever has been present since onset, more marked during the day. No nose bleed. No diarhœa for last few days.

Status Presens.—Admitted at 4 p. m. on June 2, the fourth day of disease. T = 98⅘°, P = 116, R = 24. T rose to 105.5° at 4 a. m. of 3d inst. R = 28, P = 116.

The note dictated by the resident physician, Dr. McCrae, on June 3 reads as follows: "Patient very ill; face flushed; mind dull; pupils equal and active; tongue slightly coated; mucous membranes of fair color; throat somewhat injected with some swelling on left side of uvula.

Thorax flat; expiration slightly less on right; percussion note over right front and right back slightly impaired; vocal fremitus, if anything increased on right side; breath sounds harsh but clear throughout left lung; rather higher pitched and more prolonged expiration on right.

Heart: P. M. I. in 5th i. s. 10 cm. from m. s. l. R. C. D. diminished. Sounds rapid; 1st much like 2nd. Pulse, 34 to ¼, very small, regular and not dicrotic.

Abdomen: Slightly full; no positive rose spots; spleen not felt.

Sputum: Tenacious, muco-purulent, slightly streaked with fresh blood; microscopically many pus cells, and clumps of bacilli and diplococci; no tubercle bacilli.

Urine: Negative except for slight trace of albumen.

Blood: Negative for parasites; leucocytes, 13,300.

June 4 (6th day).—T, which fell to 99.6° 12 noon of 3rd, has since ranged from 101.6° to 104.5°. P = 112-132, R = 28-32. Very restless during the night and slightly delirious. Signs of consolidation over right middle lobe more definite. Left lung clear. Heart negative. Leucocytes 10,400. Blood culture at 2 p. m. proved negative.

June 5 (7th day).—General condition about the same. T = 100.6°-104.2°, P = 96-130, R = 28-40. No change in physical signs of lungs. Heart: A few *suggestive scratches* heard over base of heart synchronous with systole. Pulse difficult to count owing to marked tremor of hands; very soft and small. Complains of pain in *right shoulder joint.* No redness, no swelling; slight tenderness posteriorly. Leucocytes 8,100.

June 6 (8th day).—Temperature rose to 105.5° at 7 p. m of 5th inst., but fell steadily during the night, reaching normal at 6 a. m. Rather cyanotic. General coarse twitching of both upper extremities. Signs of resolution of consolidated middle lobe. Left lung clear. Heart: Sounds at apex a trifle feeble but clear. Near the sternum in 3d, 4th and 5th i. s. is heard a *murmur with systole,* which has a curious, somewhat superficial scratching quality, suggesting a pericardial rub but not characteristic; audible at aortic area, where 2nd sound is somewhat accentuated. Right shoulder joint painful and tender, but not red nor swollen. Leucocytes 9,100.

June 7 (9th day).—T = 101.5°-104°, P = 108-120, R = 28-48. Patient semi-comatose. Pupils equal; no strabis-

mus. Stiffness of neck muscles marked. Arms flexed at elbow. Tendon reflexes of uppers absent. Patellar reflex absent. No ankleclonus. Babinski's sign doubtful. Kernig's sign marked. Inflammation of right shoulder subsiding. Blood negative to parasites. Leucocytes 10,200.

June 8 (10th day).—T = 101.4°-103.5°, P = 100-132, R = 28-44. Delirium rather more marked. Pupils equal and active. Does not answer questions. Marked general tremor, retraction and rigidity of neck. Kernig's sign pointed. *Right ankle joint* shows light swelling and redness, but no tenderness. Consolidated right middle lobe gradually undergoing resolution. Some area of purpura over right back. Lumbar puncture, 20 cc. withdrawn under normal pressure, negative in smears and cultures. Blood culture showed heavy growth of pneumococci in plates and flasks in 24 hours. Widal negative.

June 9 (11th day).—T = 102°-105.7°, R = 28-44, P = 100-140. Patient roused with difficulty. Pulse of fair volume, regular but distinctly *collapsing*. Pupils equal. Twitching of muscles of face, neck and arms. Other signs of meningitis as before. Right ankle joint shows more marked signs of inflammation. Heart sounds well heard at apex, second followed by a *diastolic murmur*, of maximum intensity in 2nd r. i. s; first clear everywhere. Marked pulsation in peripheral vessels; faint capillary pulse. Leucocytes 10,300.

Aspiration of right ankle joint at 7 p. m. yielded 2 cc. of turbid, milky fluid. Typical pneumococci in smears and cultures. Death at 9.05 p. m.

Autopsy performed 14 hours after death by Dr. Van Wart.

Anatomical Diagnosis.—Lobar pneumonia with gray hepatization (right lung); chronic adhesive pericarditis; ac. aortic endocarditis with ulceration of aortic valve; ac. tricuspid endocarditis; fatty myocarditis; atheroma of aorta and coronaries; cirrhosis of liver; chronic interstitial pancreatitis with fat necrosis and abscess formation; chronic nephritis and fatty degeneration of kidneys; ac. splenic tumor; meningitis; acute arthritis; hypertrophy of prostate.

Thorax: L. pleura contains 100 cc. of slightly blood-stained fluid. L. lung adherent at apex; right lung adherent at apex and upper part of lower lobe posteriorly. Left lung negative except for healed tubercle at apex. Right lung smaller than normal; scar at apex; middle lobe in condition of gray hepatization.

Heart: Pericardium adherent by recent fibrinous adhesions. Tricuspid valve (13 cm.) showed a large, pale, irregular mass on auricular surface, measuring 1 x 1.5 cm., pedunculated and floating free. Pulmonary and mitral valves normal. The aortic valve (8 cm.) showed slight sclerotic change. The right posterior cusp of the aortic valve showed recent vegetations and considerable ulceration, resulting in the right base of segment being eaten through and floating free. Myocardium soft, pale red, and on tangential section showed yellow streaks. On the coronaries patches of sclerosis.

Spleen (130 grammes): Soft and flabby; mottled; pulp soft and structure made out with difficulty.

Liver: 1650; slightly enlarged and of very irregular shape; on section there is considerable increase in connective tissue arranged about lobules.

Stomach and intestines negative.

Pancreas: 12 x 2.5 x 1.5 cm.; very firm, cutting with difficulty, except in head near lower border, where there is a small abscess cavity (1.5 x 1 cm.), communicating with duct of Wirsung. Throughout organ numerous opaque yellow areas with softened center. Connective tissue considerably increased.

Kidneys: Show characteristic changes of chronic nephritis.

Bladder: Negative; urine negative to sugar; hypertrophy of middle lobe of prostate.

Right ankle slightly swollen and on opening it the surrounding tissues were found to be slightly infiltrated with serum. The joint itself contains considerable quantity of purulent fluid, and the cartilage covering it has lost its smooth, glistening appearance. No evidence of extension of the process to the surrounding bone.

Brain: The calvarium more adherent to dura than normal. Dura normal beyond increase in number of Pacchionian granulations. Cerebrospinal fluid not increased. The pia and arachnoid somewhat opaque, as were the veins in the sulci, but not more so than usually seen in senile or insane brains. Pial arteries prominent. The circle of Willis showed slight sclerosis. Pons, cerebellum and cranial nerves apparently normal. Sections from various parts of cerebral cortex showed very few leucocytes, otherwise negative. Sections stained by Nissl's method showed the usual changes in the Nissl bodies in acute infections.

Bacteriological Report.—A. *Clinical.*—The first *blood culture* was taken on the 4th inst., the 6th day of illness; 12 cc. of blood were withdrawn from the median cephalic vein. This was divided between five Erlenmeyer flasks, each containing 150 cc. of medium; three of litmus milk and two of bouillon. They were incubated for 5 days at 37° C., but proved absolutely sterile.

The second blood culture was taken on the 8th inst., or 10th day of disease; 14 cc. of blood were withdrawn and divided between three flasks of litmus milk, two of bouillon and six tubes of agar-agar. The latter were plated. Next morning all six plates showed very numerous opaque, white, circular, pin-point colonies, which under low magnification showed sharply defined periphery and dark nut-brown color. Smears stained by Welch's method show typical lanceolate diplococci with fairly definite capsule.

In 48 hours all litmus flasks were acidified and coagulated, and the bouillon was turbid, while the blood was changed to dark olive green color.

The *lumbar puncture* taken on the same day was absolutely negative.

Culture from ankle joint, taken two hours before death.—About 2 cc. of blood-stained turbid fluid were withdrawn. This was divided equally between one bouillon tube, one slant agar tube and one blood serum slant. Smears stained by the ordinary stains showed numerous polymorphonuclear leucocytes, but no diplococci. The tubes were incubated for 12

hours, when 6 agar-agar plates were made. A series of three by adding with 5 öses of bouillon tube to first agar and so on to third dilution. The remaining bouillon was then divided equally between three other agar tubes and plated. The slant cultures proved negative, as did the plates in first 24 hours. In 48 hours the first series of plates was negative, but the second series showed few typical pneumococcus colonies, smears from which were stained and showed typical lanceolate diplococci with well-defined capsules.

The organism isolated from the blood and that from the ankle joint were run through the various media and showed typical growth in slant agar, glucose, agar, potato, bouillon, Dunhams, litmus milk and gelatin. On the former it was chiefly characterized by its very light, almost invisible growth; it acidified and coagulated milk; and in gelatin there was little or no visible growth and absolutely no liquefaction.

A 24-hour agar culture from each was inoculated intraperitoneally into two mice. The mouse inoculated with the joint organism died in less than 24 hours, and the organism was recovered in pure culture from the heart's blood, and peritoneum; smears showed beautiful typical capsules and the cultural characteristics were absolutely identical with those of the original stock. The mouse inoculated with the organism from the blood died in about 48 hours, and from its heart's blood and peritoneum diplococci with its typical cultural characteristic and capsule were demonstrated. This organism was not so virulent owing to the longer interval that had elapsed from its primary isolation.

B. *Post mortem.*—Owing to the absence of the bacteriologist, Dr. Van Wart kindly asked me to take the cultures.

Pleura, pericardium and spleen showed pure cultures of staphylococci pyogenes aureus.

The *heart's blood* showed few *pneumococci* in smears and on the plates, but transfers showed no growth.

From the vegetations on the aortic cusps, which was previously seared with a red hot knife, a small fragment was broken off and macerated in an agar tube. From it was recovered the pneumococcus with the B. proteus vulgaris and staphylococcus aureus.

The cerebral meninges yielded a pure culture of pneumococcus, and few pneumococci were demonstrated in the smears. The right ankle joint also contained pneumococci with a few colonies of staphylococcus albus. From the peritoneum: B. proteus vulgaris, B. coli communis, strept. pyogenes and staph. albus. From the pancreatic abscess: B. coli communis and staph. aureus and albus.

In this series, just as in the former, all the ordinary media were employed for identification, the only difference being that the organism was not run through a mouse in every case.

The above history is given in detail to depict more vividly the interesting sequence of events which occurred in the course of the disease.

The signs of consolidation of right and middle lobe were never absolutely typical but sufficient to warrant a diagnosis of consolidation at least. This, with the high though typical temperature curve, the leucocytosis, the delirium and the toxic facies all pointed clearly to lobar pneumonia. As the amount of lung involved hardly warranted the grave condition, a septicæmia of a very intense form was thought to be present, in spite of the fact that the blood culture taken on the 6th day of disease was negative. An arthritis of the right shoulder was suspected on the 7th day. This was soon followed by the development of an acute vegetative endocarditis of the aortic valve as shown by the appearance of a loud systolic murmur of maximum intensity in aortic region. On the following day definite signs of meningitis appeared. Then on the 10th day the right ankle joint became acutely inflamed. A lumbar puncture taken on the 10th day was negative, but the blood culture showed both in fluid and plate media a heavy growth of typical pneumococci. On the 11th an interesting development occurred: The pulse became collapsing and the systolic aortic murmur was replaced by a harsh diastolic. This at the time could not be explained, but the autopsy cleared away the difficulty, as it was found that the acute inflammatory process had ulcerated through one of the aortic cusps, thereby producing a considerable insufficiency of the aortic valves.

A culture from the right ankle joint was postponed as long as possible, as it was felt that the further the process proceeded the more chance there would be of getting some fluid from the joint, which showed apparently little or no effusion. The joint was aspirated about two hours before death and the pneumococcus later isolated.

The post-mortem findings confirmed the clinical diagnosis in most respects. The middle lobe of right lung was in the stage of gray hepatization. The adhesive pericarditis was suspected from the peculiar scratching sounds over body of the heart. The acute ulcerative endocarditis of the aortic valves has already been referred to. The involvement of the tricuspid valve was not suggested by the physical signs, though owing to the frequency with which the right heart is involved in acute infective endocarditis no surprise was experienced. The arthritis of the ankle joint was proved by additional cultures taken after death and by laying open the joint and seeing the inflamed condition of the synovia. The right shoulder was not opened.

The appearance of the meninges post mortem was not incompatible with ordinary œdema, and it was only by smears and cultures that meningitis was proved to exist, typical diplococci being obtained.

The hepatic cirrhosis and chronic nephritis were accounted for by the patient's alcoholic habits. The pancreatic abscess formation plays no part in the present history.

Owing to the kindness of Dr. R. M. Van Wart, assistant pathologist to the Bay View Asylum, I take this opportunity of reporting two additional cases in outline, the data of which he generously supplied.

Case 2.—*Clinical Summary.*—Male; æt. 79; admitted on 3rd day of disease with lobar pneumonia; arthritis of left shoulder 7th day; right knee joint 8th day; left knee joint 9th day. Death on 9th day.

Anatomical Diagnosis.—Lobar pneumonia; acute fibrino-purulent pleuritis; acute purulent lepto-meningitis; acute purulent arthritis of left shoulder, right and left knee joints; acute splenic tumor; arterio-sclerosis; chronic nephritis; hypertrophy and dilatation of the heart; cloudy swelling of the heart, liver and kidneys.

The pneumonia was confined to a small area at the apex of the right upper lobe, involving about one-third of its substance. The meningitis was extensive, involving the vertex and base alike. The exudate was of a sero-purulent type, there being a large quantity of thin purulent fluid in the subdural and subarachnoid spaces. Smears from the exudate showed many typical capsulated diplococci.

The left shoulder and right knee joint contained large quantities of purulent fluid. Smears showed capsulated diplococci. The left knee joint showed only a small amount of clear fluid post mortem, though before death it was painful and red and swollen. No cultures, unfortunately, were taken.

Case 3.—*Clinical Summary.*—Female; æt. 69; transferred from insane pavilion to hospital for *mitral insufficiency* with loss of compensation and *general anascarca; lobar pneumonia* 10th day of disease; *arthritis of right knee,* 10th day; *death.*

Anatomical diagnosis.—Lobar pneumonia (gray hepatization); *acute vegetative mitral endocarditis; acute purulent arthritis; acute splenic tumor; cloudy swelling of heart, liver and kidneys; arterio-sclerosis; chronic nephritis; hypertrophy and dilatation of heart; chronic passive congestion of viscera; hydrothorax; ascites; general anasarca.*

The pneumonic consolidation involved only a small area on the apex of upper right lobe. The vegetations on the mitral valve were large, soft, easily detached and of very recent formation, resembling those of Case 1. The brain showed no evidence of any lesion, beyond congestion of the pia, and smears from it were negative. The smears from the mitral vegetation and joint fluid showed presence of typical capsulated lanceolate diplococci. No cultures were taken.

Many writers have reviewed the literature of this subject very extensively, and I shall only refer to two recent articles that have appeared since R. M. Slaughter's paper in *American Medicine,* April 18, 1903.

The first is a report of a case by N. Raw in the *Practitioner* for April. This was a most interesting and very unusual case. In addition to double lobar pneumonia, followed by double empyema, there was an acute glossitis, due presumably to the pneumococcus which was the forerunner of the pulmonary and articular involvement. This case of glossitis is the only one in the literature that I could find. The involvement of the left temporo-maxillary joint also is rare. The development of double empyema, from which the patient was ultimately convalescing at time of the report, forms the climax of this interesting case.

Only one other recent paper could I find in English, French or German literature, which has not been previously reviewed. The latter is one entitled "Einige seltene Lokalisationen des Pneumokokkus," by Zamfirescu, of Bukarest, which appeared in the Spitalul, 1903, Nr. 3 (Rumanisch), and was unfortunately inaccessible. In a review of it in the *Centralblatt für Innere Medizin,* Nr. 29, 1903, we learn that the writer reports three cases of unusual infection with the pneumococcus, one with arthritis and myositis, the second with infective phlebitis, and the third with myositis alone.

I append a table of my cases following the plan set by Cave, Cole, Herrick and Slaughter in their excellent monographs. These four cases bring the number of pneumococcic arthritis to seventy-two.

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6. Raw: A case of severe Pneumococcic Infection. Raw, The Practitioner, April, 1903.

7. Zamfirescu: Einige seltene Lokalisationen des Pneumokokkus. Spitalul, 1903, Nr. 3 (Rumanisch).

No.	Observer.	Date.	Age.	Sex.	Relation to Pneumonia.	Seat of Arthritis.	Nature.	Result.	Complication.	Treatment and Remarks.
69	Raw.	1903	41	F	During double lobar pneumonia.	Left temporo-maxillary joint.	Purulent.	R	Ac. Glossitis Double Empyæma.	Incision and drainage of joint. Smears and cultures show typical pneumococci.
70	Howard.	1903	42	M	During pneumonia of rt. mid-lobe.	Right shoulder 7th; right ankle joint 10th day of disease.	Sero-purulent.	D	Septicæmia, ac. ulcerative, aortic and tricuspid endocarditis, meningitis, pericarditis.	Blood cultures on 10th day showed pneumococci in cultures. Aspiration from ankle joint showed pneumococci in smears and cultures, lumbar puncture negative
71	Van Wart-Howard.	1903	79	M	During pneumonia of upper lobe rt. lung.	Left shoulder 7th day; right knee 8th day; left knee 9th day.	Purulent.	D	Ac. pleurisy, ac. purulent, lepto-meningitis.	Pneumococci in smears from left shoulder and right knee and cerebral meninges at autopsy. No cultures.
72	Van Wart-Howard.	1903	69	F	During pneumonia of apex of rt. upper lobe.	Right knee joint.	Purulent.	D	Ac. vegetative, mitral endocarditis, ch. nephritis.	Smears from vegetation and joint showed pneumococci at autopsy.

THE PLAGUE IN INDIA.

A STUDY OF THE RESULTS OF THE HAFFKINE PROPHYLACTIC.[1]

By B. Rosalie Slaughter, M. D., *Washington, D. C.*

I have felt much honored in being asked to read a paper before you, but my pride has not prevented me from realizing my temerity in attempting to offer anything new on a subject with which you are already so familiar through the interesting report of the Medical Commission of the Johns Hopkins University and their associates, and the various excellent compilations and articles which have been published in America.

These leave practically nothing more to be said as to the nature and forms of plague, and indeed cover all ground connected with it to such an extent that it will be impossible for me to avoid some repetition. There seems, however, to be some doubt:

1. As to the length of time during which Haffkine's prophylactic renders a person immune.
2. As to the length of time before it acts.
3. Whether it is injurious to those who are incubating the disease.
4. Why, in spite of England's systematic efforts to exterminate the plague, so little has been accomplished?
5. Whether the inoculation increases the liability to other diseases.
6. Whether Haffkine's prophylactic is of real value in reducing the plague mortality, since the latest reports from Bombay seem to show an increase in the plague death rate.

Therefore I have thought that it might be well to take up these few points rather than attempt to go further afield in the limited time before me.

Through the courtesy of foreign and native physicians, I was, during my two months' stay in India, enabled to visit the hospitals and infected districts in many towns in the different provinces where I was given opportunity to observe cases and conditions, and to consult records upon which I base this paper.

1. As to the Length of Time the Prophylactic Confers Immunity.

Mr. Haffkine told me that he had found his prophylactic afforded protection from 4 to 6 months, or the length of one epidemic, though in some cases he had known its power to last even longer. For example, he cited statistics compiled by the collector of Dharwar from researches made in the plague laboratory there, showing that the effect had not worn off after 18 months or 2 years.

The consensus of opinion in India is, however, that while it may be effective for a longer time, for 3 months it is absolutely safe. It is, therefore, the common practice among those who are working in plague districts to be reinoculated every 3 months, and it is not resorted to oftener, although in some districts it has been thought best to begin counting the 3 months from the date of the second inoculation, which is made about 20 days after the first inoculation, as this method of double inoculation has been found to be highly advantageous. For example, at Hubli, Dr. Leuman found the immunity possessed by the twice-inoculated to be 10 per cent greater than that possessed by the once-inoculated, and his experiments were so interfered with by the ignorance of the natives that he argues if reasonable account were taken of this, a juster statement would be to estimate at 20 per cent the increased degree of immunity conferred by the second inoculation within from 20 to 30 days.

He emphasizes this by calling attention to the statistics relating to the inoculation of the employes of the Southern Mahrátta Spinning Co., which was done by the wish of the native manager, Mr. Narayenrao.

There were 1173 mill-hands on the muster roll, and of these 1040 were twice inoculated, with a death roll of 22 or 2.11 per cent. 58 were inoculated once with a death rate of 8, i. e., 13.79 per cent. 75 refused to be inoculated and show a death rate of 20, i. e., 26.6 per cent. If the twice inoculated had died in the same proportion as the uninoculated, the number of deaths among them would have been 286 instead of 22, and if the once inoculated had died in the same proportion as the uninoculated their plague death roll would have been 16 instead of 8.

In India the dose is ordinarily 5 cc. and often more. In 1897, Mr. Haffkine caused himself to be inoculated with 10 cc., and frequently if the reaction is slight from the first inoculation of the standard dose of 5 cc., a larger dose is given at the second inoculation. I mention this because I have noticed that the dose of Haffkine's prophylactic put up at our Hygienic Laboratory in Washington is 1 cc., and have thought it possible that the greater success of its use in India might be due to the larger dose.

2. How Long Before the Prophylactic Confers Immunity?

The length of time before it acts has been found to be less than 24 hours. For instance, in the experiments conducted at Undhera, among the inoculated no death took place before the ninth day, whereas 11 occurred among the unprotected during that time; 2 on the third day; 1 on the fourth day; 3 on the fifth day; 2 on the seventh day; 3 on the eighth day. The number of attacks is, therefore, seen to have been immediately less among the inoculated, and as the villagers were divided into two groups as evenly as possible, there is no reason to suppose that there could have been fewer persons in the incubation stage of plague among those inoculated than among their uninoculated relatives,

[1] Read before the Johns Hopkins Medical Society, May 20, 1903.

therefore inoculation evidently *immediately* aborted the disease in these cases.

In India the opinion is that inoculation acts in exactly the same way that vaccination does. The incubation stage of plague being ordinarily from 2 to 10 days, the shortest case on record, that of Chinawl Kahn (reported by Surgeon-Major MacCartie, January 11, 1897), was 36 hours, still the prophylactic requiring only 24 hours to act will in that time either arrest the disease or modify its severity.

For example, the prisoners in Byculla Jail, all of whom were equally exposed to infection, were divided into two groups as exactly alike as possible, the members of one group inoculated, the others not. Out of the 172 of the latter group there were 12 cases with 6 fatalities. Out of the 147 of the inoculated there were only 2 attacks and no deaths. From the following table it will be seen that the difference between the two groups was manifest within 24 hours of the time of inoculation, thus showing that the prophylactic acted in 24 hours.

	Uninoculated.		Inoculated.	
	Cases.	Deaths.	Cases.	Deaths.
1st day	2	1	1	0
2d day	1	1	0	0
3d day	1	1	0	0
5th day	1	1	0	0
6th day	2	1	0	0
7th day	5	1	1	0

3. Is inoculation harmful in the incubation stage of Plague? In answering this I shall quote from a paper presented before the Royal Society of Edinburgh in September, 1900, by Dr. W. B. Bannerman, Major in the Indian Medical Service. He says:

"We find Calmette asserting before the International Congress of Hygiene at Paris, that 'a person in the incubation period for a slight attack of plague would find the disease considerably aggravated if he submitted during this period to a preventive inoculation of Haffkine's vaccine. The case would almost certainly end fatally.'"

Some months later the same scientist emphasizes this expression of opinion in the Harben lecture delivered by him in London, and condemns the practice of inoculating with Haffkine's fluid those who have been in contact with a plague case. These opinions he founds on laboratory experiments only, never having had an opportunity to use the plague vaccine during an epidemic among human beings. It is well known, however, that the immediate effect produced by the action of a microbial virus varies with each species of animal operated on, and that quite as various degrees of immunity are produced in them by this means, so that it is impossible without trial to predict what the exact action on any fresh species may be.

We must take experiments on animals as an indication merely of what may be expected if the same procedure be applied to man and it is quite legitimate, therefore, to set aside this dictum of Calmette's if we find from the examination of a sufficient mass of evidence derived from human beings that there is no harm apparent to those inoculated during the incubation stage of plague.

Inoculations have been carried out on a large scale in various parts of India, hundreds of thousands of persons (over 200,000 in Bombay city alone) having been operated on during the last four years. From the reports sent in from certain prisons and small villages, where accurate statistics have been kept, it has been found possible to compile the following table showing the case-mortality in persons inoculated during the incubation period of plague. These figures include all instances known to us in India where statistics have been kept with sufficient accuracy to admit of the compiling of this information:

	Attacks.	Deaths.	Case-Mortality per cent.
Cases which had plague actually evident at time of inoculation, or which developed it the same day.	43	21	48.8
Cases which developed plague on 1st day after inoculation	40	23	57.5
Cases which developed plague on 2d day after inoculation	40	22	55.0
Cases which developed plague on 3d day after inoculation	38	21	55.3
Cases which developed plague on 4th day	27	10	37.0
Cases which developed plague on 5th day	37	18	48.6
Cases which developed plague on 6th day	26	10	38.5
Cases which developed plague on 7th day	29	14	48.3
Cases which developed plague on 8th day	24	9	37.5
Cases which developed plague on 9th day	24	15	62.5
Cases which developed plague on 10th day	30	9	30.0
Total within the first 10 days after inoculation	358	172	48.04
Cases which developed plague subsequently	566	230	40.6
Total plague cases among the inoculated	924	402	43.5
Total plague cases among the uninoculated portion of the population during same epidemics	5,079	3,726	73.3

We have here records of over 6000 attacks of plague, with a case-mortality in the inoculated of 43.5 per cent, and in the uninoculated of 73.3 per cent. If Calmette's contention were correct, we should see a case-mortality of over 73.3 per cent among those who were inoculated either with the plague symptoms already manifest or who developed plague within the next few days. But what do we find? According to the table, we see that on no occasion does the case-mortality even approach to such a figure; even those inoculated with the disease already manifest have a case-mortality of 48.8 per cent only, instead of 73.3 per cent.

It appears that in these statistics we have a sufficiently large body of trustworthy evidence to enable us to set aside Calmette's warning—founded as they are on laboratory experiments on animals only—and to encourage us to inoculate *all* persons during a plague epidemic, whether they have been exposed to infection or not. One is further encouraged in this by the opinion of almost all of those who have had practical experience of the measure—for instance, Dr. Alice M. Corthorn, B. Sc. M. B., London, who, with her own hand, performed some 32,000 inoculations in the towns of Dharwar and Gadag, says: "I think that these and the Dharwar figures prove that, so far from its being inadvisable

to at once inoculate the contacts of a case of plague lest they be incubating the disease, it is desirable at once to inoculate all who have been exposed to infection."

Again, in a report on plague at Sydney, Australia, Dr. Ashburton Thompson, the Chief Medical Officer of the Government, and President of the Board of Health, reports: "Among the inoculated public, 13 were attacked . . . all these patients not only recovered, but had conspicuously light attacks. It was noticed that attacks which occurred at, or before the lapse of about 10 days, from the inoculation were not aggravated by it."

It may be stated that of the 13 cases noted by Dr. Thompson, 11 occurred within periods varying from the actual day of inoculation to the 7th day after the operation. Although I have not been able to find that the Indian Plague Commission considered this actual point, yet in their report they incidentally remark when considering how soon protection is acquired, that "the case-mortality of the first three days compares favorably with that of uninoculated patients," and in another place recommend "the encouragement of inoculation among persons left in the houses with the sick," thereby certainly implying that there could be no risk in such a procedure.

We may then confidently say that the plague vaccine is harmless to those incubating the disease.

This is reasonable in view of a similar condition in smallpox, for when a person is vaccinated after contamination, the disease is ordinarily aborted or modified. In rabies the addition of the attenuated virus of Pasteur to that already in the system does not aggravate the patient's condition. Although since Calmette's statement it has been said by those who also viewed the question theoretically, that the "adding of inoculation toxine to the virus the patient may already have in his system, will produce fatal results." The actual facts, collected from a wide experience with human beings, do not justify any such apprehension on this subject.

The line is, however, to be drawn when a person presents himself for inoculation with severe headache, tenderness in the glandular region, temperature of 100° F. or over, because the plague having then developed, the usefulness of a prophylactic measure is past.

In inoculating great numbers in India, it has sometimes happened that plague symptoms existed at the time of inoculation or have developed within the next 12 or 24 hours, but an observation of these cases has shown them to be negative, for they were no worse than those in the uninoculated, and no beneficial result was obtained. Of course if, immediately after inoculation, a patient developed headache, glandular enlargement which did not subside in a few days, etc., it would naturally be thought that the inoculation precipitated the plague. Thus the mistaken idea would arise, from the fact that the patient already had plague, and the symptoms naturally incident to the reaction following inoculation would be continued right on into the attack. It simply means that the prophylactic was not given early enough to abort the disease. The presumption that inoculation causes the attack is out of the question, as the prophylactic does not contain any living germs. We therefore arrive at the very important conclusion that persons in whose family cases of plague have occurred, or who are or were recently in attendance upon plague patients, or who have otherwise been exposed to infection, and may therefore have infection in them, but do not show actual plague symptoms, should be inoculated without hesitation, as early as possible, and in exactly the same way as ordinary persons, with every likelihood that they will benefit by it.

4. Why, in spite of England's persistent efforts to exterminate the plague, has so little been accomplished? For this there are several reasons.

First, because the earnest and intelligent work which is being done covers, after all, a comparatively small area of the great Indian Empire. Second, because, even if every case of plague in a town is cured to-day (after general inoculation the plague disappears in from 30 to 47 days) and the villagers persuaded to adopt the most hygienic conditions of living, by next year, their fright having passed, they will grow lax and indifferent. Many who have learned something of hygiene will have left on business or pilgrimage, and others will have come in from neighboring towns bringing with them utterly unhygienic customs. One of these that assists in rapidly spreading the plague in pneumonic cases, is that the patients expectorate into the hands of their sympathetic attendants.

3d. Natives who fly on the outbreak of the plague and live in shacks built on the moist ground and among whom ambulant cases develop, when they return bring with them attenuated bacilli, which under favorable conditions regain their virulence, and precipitate a new epidemic as soon as winter causes the people to come again in to close quarters.

4th. There will also be Mohammedans returning from Mecca, and Hindus from Benares, who will have been in contact with plague sufferers from Egypt, or other parts of the Orient, on the one hand, or with plague contacts from thousands of native villages on the other. Since in your last Bulletin, Dr. Calvert reports that the bacillus remains viable and virulent on dried pulverized organs of animals dead of the plague for as long as 48 days, and on paper or silk, in a room at ordinary temperature in the sunlight, for 18 days, it is easy to realize how readily infection is carried in the dark folds of Oriental garments, for it has been demonstrated that bedding and clothing may harbor bacilli for months, and in experiments they have been kept alive in crash for 97 days.

In the laboratory experiments conducted by Dr. Rosenau, of the Marine Hospital Service, and Director of the Hygienic Laboratory at Washington, he discovered that the plague bacillus lived and remained virulent 116 days in one case and 96 in another when abundantly inoculated into water containing organic matter. Now every one familiar with India and her numerous sacred tanks and wells, sheltered from the sun, and fetid with the decaying floral gifts constantly thrown into the water by devotees, will at once

recognize that here is one of the perennial sources of the bacillus pestis. Dr. Rosenau found further that "the bacilli are long kept alive in moist, cool earth," and as the dark, native huts are almost invariably built directly upon the ground, which is kept moist by water from these same tanks used in pouring libations to the household gods, it will be seen that all the conditions which laboratory research shows to be most favorable to the growth and preservation of the bacilli are actually and constantly in existence in the country most devastated by them.

These are some of the reasons why the work of the Government has to be done over each year.

Another interesting analogy between the laboratory experiments and the history of plague epidemics as they have been observed and reported, is that the one demonstrates the greater activity and virulence of the plague germs at a low, moist temperature, and the latter shows that, as a rule, the disease rages with greater violence during the rainy season and in the winter months.

The description of one house in Bombay will, perhaps, show the difficulty under which the Government sometimes works, and how, although the prophylactic is efficacious, the Yersin serum curative, and the plague officers faithful and watchful, the result in such a case is practically nil.

Entering the house, we passed through a long, narrow, dark hall, and came into a small court which though cleaned the day before contained old rags, human excreta, and decayed vegetables. From this we entered another passage, climbed a flight of rickety steps, and reached a short, absolutely dark hall. Opening from it was a room about 6 x 9 feet which had no window. Passing through this we entered a similar room, for the house was a veritable honeycomb of dark, foul chambers, lighted only by tiny, earthen lamps, standing in niches in the wall, and usually giving out more smoke and smell than light from their oil-soaked rag wicks. In one such room a woman was cooking; in another a man was dying, and in another a rigid outline under a heap of dirty rags showed that here lay a corpse. The authorities removed the dead, disinfected the room, and a small circle with a line through it, ⊖, was put on the house to show that a death by plague had occurred there. Above the central line was put the date of the person's death, and below it the date of disinfection. In the course of the night, however, the owner of the house removed all traces of the mark, because its presence depreciated the value of his property, and promptly rented the room as soon as possible to a pious Hindu who purified the place for his occupation by covering the floor thoroughly with cow-dung.

Doubtless while the disease was incubating, the plague victim had circulated freely among his neighbors, and it would be impossible for the authorities to disinfect the whole house without causing a riot on the part of the 150 other inmates who would consider it an unpardonable intrusion upon their privacy and an insult to their religion. It not infrequently happened that when the plague inspector was expected to visit a house if there chanced to be a plague corpse there, it would be propped up against the wall, or placed in the attitude of grinding corn, or of eating a meal. In reply to inquiries the relatives would reply "all well," and when night came the dead would be laid in the street at a considerable distance from where he had lived, or if the survivors could afford it, the body would be carried to the burning-ghat, the carriers often falling dead by the side of the pyre and the mourners returning to their homes scattering infection broadcast. And again, although the city is divided into districts each of which has an office in the middle of the street, to be easily accessible for reporting cases, and although special plague hospitals are erected and segregation camps are provided, so long as plague can be concealed it will be; because the natives dread returning from work to find wife or child carried off, they know not where, and themselves doomed to uncertain detention. For this means to them the death of a loved one among strangers, and a loss of wages for ten days, or of their position entirely.

Our natural question is, why do not the authorities compel the people to observe the laws of hygiene, and why do they not police more closely the streets and houses? This has not always been found to be an easy matter in America, and it is far more difficult in India. England has not forgotten the lesson of the Mutiny, nor the disregard of native prejudices, racial and religious, which caused it, and she knows that in all her work for the people she must move gradually and with caution, teaching them first of all to understand and appreciate her motives.

In this work as well as in that which they have done in the hospitals, the aid of the missionaries has been of incalculable benefit. One of the most active workers among them was Dr. Bertha Caldwell, of Johnstown, Pa., who thoroughly understanding the people among whom she had lived and done much excellent work, was able to gain their confidence and persuade many of them to be inoculated, when they had positively refused to submit to the operation at the hands of the plague officials who had come to the town at the beginning of the epidemic and were therefore entire strangers to them.

It would naturally be thought that the natives in seeing the benefit derived from inoculation in neighboring towns would need no argument or persuasion to induce them to submit to it themselves, but it must always be remembered that the plague is most active among the ignorant and superstitious, and that it requires infinite tact to overcome their belief in fatality and allay their suspicions that, since the Europeans suffer so little from this dread disease, it is either a curse brought upon them by the God of the Christians, or some scheme of the English Government to weaken and destroy them as a race. So persuaded are they of the truth of this latter assumption that it was often impossible for the plague officials to enter a house unless all the adult inmates in it were already dead, and only children left; these would be taken to the segregation camp, the house unroofed, the floor dug up and disinfectants liberally used.

One great difficulty in the way of effectively policing

the streets is that when the plague starts it spreads like wild-fire, so that often there are not enough living left to bury or burn the dead, and these latter are sometimes left lying in the streets until, as at Allahabad, where 20,000 died in a short time, the authorities were compelled to fasten long lines of corpses together, the ankle of one cadaver being tied to the wrist of another, and by means of mules drag them to the river and there cast them in for the crocodiles to dispose of. This method, of course, involved danger in spreading the infection further, as bits of the contaminated flesh were left on the stones by the roadside, but this was better than leaving whole unburied bodies in the streets and houses. Curiously enough, the grim undertakers to which the hapless victims of the plague are thus consigned, the crocodiles, are in no way injured by devouring these disease-infected bodies which are literally swarming with plague bacilli. Examination of the stomach of a crocodile soon after it was known to have eaten one of these corpses showed that the bacilli had been destroyed.

The same fact has been observed in the stomachs of the vultures which devour the Parsees who have died of the plague soon after they are laid in "the towers of silence."

This opens an interesting field of investigation.

From the foregoing explanations it will be seen that the struggle against plague in India must be carried on under conditions that we in America will never be obliged to face, so it is difficult for us to realize the difficulties under which England labors. The efforts of the physicians and their assistants have borne fruit wherever they have been able to handle small bodies of people systematically, and unhampered by native prejudice. In these cases the results have been so gratifying that many influential natives have asked to be treated by English methods, and have urged all their employes to submit to inoculation.

Among these are, His Highness Sir Aga Sultan Khan, of Bombay; Mr. Narayerao, and Parsi leaders like Mr. Jamsetjee N. Tata, and the distinguished Mr. Shanusul Telma Mody, and their example has led to an acceptance of the prophylactic as originally prepared. When it was first introduced by Mr. Haffkine the supersensitive consciences of the Hindus took instant alarm on account of the animal basis of the culture medium. To quiet the riots that ensued, Mr. Gibson, of the English Government Laboratory at Parel near Bombay, prepared a medium out of wheat, from which the starch had been washed, but in a short time the successful results from the use of the prophylactic were more effectual than many arguments in overcoming native scruples.

This fact, combined with the earnest and intelligent assistance given by such men as I have mentioned above, in furthering the efforts of the Government, is ground for much encouragement in expecting the material lessening of plague in India, and consequently in the world.

It is interesting to discover why, in spite of these facts, there is still an increase in the plague death statistics. One reason is that with the growing confidence in the authorities, cases in Bombay are no longer concealed, as they still are in some of the other towns, but are, each year, more fully and generally reported, therefore, although more cases do not really exist, more appear on the statistic sheets. In addition many cases of ambulant, septicæmic, pneumonic and intestinal plague formerly were not recognized as such, and were therefore excluded from the statistics. Again, the natives, seeing the good results of inoculation, went from absolute distrust of it to the other extreme, and now expect it to be infallible, and when a failure does occur are quick to call attention to the fact, and others point out the cases among the uninoculated with a scientific interest that formerly did not exist.

Another cause of the increased statistics is the present co-operation of the native practitioners with the English authorities, a wise step on the part of the latter, for it has had the result of inducing the former to report, instead of conceal, as they did at first, any case of plague coming under their notice. The Government has come to recognize that the native doctors have considerable skill in dealing with this disease, and that, when given a trial they succeed in curing a fair percentage of the cases under their care, and so put one of them in charge of a hospital in Bombay. The result of this innovation has been the growth of a much more friendly feeling on the part of the natives.

While in Bombay I tried to ascertain from the Hindu physicians what herbs they use in dealing with the plague, but was unsuccessful, for their empiric practice is carried on from father to son, and the secrets discovered by each one are regarded as "stock in trade" and are therefore zealously guarded.

Observations in India show that men are more suspectible to plague than women, but that when women are attacked they die in greater numbers.

And although the infant mortality in India is tremendous from other diseases, they are almost entirely exempt from the plague.

The native ideas concerning inoculation were very diverse. Some thought it would cure everything, and therefore sought it as a curative measure for many ills, and were greatly disappointed when their special disease failed to yield to the new treatment, sometimes going so far as to declare it had made them much worse. The native doctors themselves often asserting that the prophylactic increased the liability to other diseases among those inoculated.

Another opinion very widely held was that those who were inoculated would in four years' time inevitably develop leprosy. Since, however, that time has more than passed without a single case being recorded, it may safely be considered as purely imaginative.

5. Does inoculation increase the liability to other diseases?

Naturally since the introduction of Haffkine's prophylactic, a certain number of those inoculated with it who suffered from chronic diseases have died and some have recovered, so in order to settle the question whether the prophylactic itself had any effect, one way or the other, upon these cases, a record was kept of the yearly deaths among

the Sepoys, who are the picked native soldiers, and represent the healthiest body of men in India. This record was compared with a similar one kept among the same number of inoculated villagers, with the result that the number of deaths was found to be greater among the Sepoys, proving that so far from being injurious, inoculation improved the general health of the community.

After observing special cases, Surgeon-Captain Leuman reported eczema, particularly the pustular variety, frequently improved, and was sometimes cured after inoculation, while lupus in 4 cases that he noticed grew worse, and in a few cases of pulmonary tuberculosis the cough was aggravated, the temperature and early morning sweats increased temporarily, but there were no continued ill effects. This, however, has little significance, for the constitutional reaction caused by inoculation would reasonably add to the usual temperature of chronic tuberculosis.

6. The question as to whether the prophylactic really is of any benefit can, I think, be best answered by realizing its "as-a-matter-of-course" use in India, the injection of 5 cc. every three months during the plague epidemic being almost as customary as vaccination is here. The general immunity of doctors and nurses who have been inoculated is not a strong argument for the prophylactic, since they all wear shoes, and on account of their sanitary habits, are never, at any time, in very great danger, but experiments like that at Undhera are, on the other hand, absolutely convincing.

Undhera is a village 6 miles from Baroda, and there Mr. Haffkine, accompanied by Major Bannerman and a number of prominent men of that district, including local physicians, conducted a from house to house visitation, calling out the inmates of each by reference to a census paper. As each household was collected in the street half the number was inoculated, half left untreated, efforts being made to divide them equally as to age, sex, and conditions of health. As for example, in a certain family where there were 2 children, one sickly, the other strong, only the sickly one would be inoculated, but on the next similar occasion the procedure would be reversed, and in this way the population was divided into groups in as equal a manner in every way as can ever be done, but at the end of the day it was found that, owing to the insistence of the people, there had been 76 more inoculated than had been left untouched, and subsequent examination showed that there were, at the time of operation, more sickly individuals among the inoculated than in the uninoculated group. This shows that in the test made at Undhera, wherever an advantage existed, it was in favor of the uninoculated group.

Six weeks later, the Commission again visited the village, and again the inhabitants of the houses were called out by name, by reference to the census sheet, and with this result: 1st. Among the inoculated no deaths were found to have occurred from other causes than plague. 2d. There had been no deaths among them within eight days after inoculation, showing that the inoculation had had no deleterious effect. 3d. Among the 513 inoculated there were only eight attacks with three deaths, while among the 437 uninoculated there were 27 attacks of which 26 died.

One curious and pathetic incident of this second visit was that in 2 huts that stood side by side, *all* the uninoculated had died, and only the inoculated came out to answer to their names.

Earlier in this paper I have referred to the interesting fact that in this Undhera experiment 8 clear days elapsed before any deaths occurred among the inoculated, while during the same period 11 deaths from plague were registered among the unprotected, which seems to indicate that the prophylactic acted *at once*. If the inoculated had suffered to the same extent as their uninoculated relatives, they should have had 29 deaths from plague, instead of 3 only.

A striking illustration of the effect produced by the inoculation of an entire community is afforded by the history of the epidemic among the Parsi inhabitants of Daman. The Parsi community of Lower Daman numbered 306. Of these 277 were inoculated and 29 were not. The following shows the attacks and deaths in the two groups. No deaths from other cause than plague occurred in this community during the epidemic.

	Numbers.	Cases.	Deaths.	Percentage of Mortality.
Inoculated	277	8	1	0.36
Uninoculated	29	4	4	13.8

If the inoculated who were living in precisely the same social conditions as the uninoculated had been affected in the same proportion, they should have had 38 deaths instead of only one, a difference of 97.4.

It should be noticed that the solitary case of death among the inoculated Parsis had pain in the groin and fever at the time of inoculation—in fact was suffering from plague already manifest—and therefore could not be expected to derive benefit from the prophylactic.

In the Umerkhadi Jail, Bombay, plague appeared in the end of December, 1897. Three prisoners took the disease, and subsequently died. Then on January 1, 1898, inoculation was offered to the prisoners, who all, 401 in number, declared themselves willing to undergo the operation.

It was resolved, however, for the purposes of demonstration, that only one-half of each group of prisoners should be operated on. These consisted of groups of prisoners sentenced to simple imprisonment or to hard labor, civil debtors, convict warders, cooks and female prisoners. As each group was brought forward, the individuals composing it were seated in rows, and every second man or woman was chosen for operation. Two prisoners, only, refused to allow inoculation. No distinction was made between the groups of inoculated and uninoculated prisoners; they had the same food and drink, the same hours of work and rest, and the same accommodations. After this, plague cases appeared at intervals for a space of 30 days and were distributed as follows:

Average.	Population.	Cases.	Deaths.	Remarks.
Inoculated	147	*3	0	* The disease was so mild in these cases that the hospital authorities were doubtful whether they were cases of plague.
Not inoculated.	127	10	6	

My last illustration I shall quote from the report of the plague in Bombay Presidency compiled by Captain J. K. Condon.

Plague cases began to appear in Belgaum—a town of 40,700 inhabitants—on October, 1897, 5 deaths being reported in that month. In November, 111 deaths occurred, 156 in December, 226 in January, and 50 in February, after which an insignificant number of attacks took place, till in May the epidemic ceased. The Twenty-sixth Regiment of Madras Infantry were, during this period, living in lines close to the cantonment and city, and suffered similarly. The first reported case among them took place on November 12, when Sepoy 2224, Govindswamy, was brought to hospital and died the same day. Next day another Sepoy was attacked and also died. On the 15th, a drummer was seized, and on the 17th, the disease appeared among the followers. By the 31st, 13 attacks had been reported from the lines, 4 of these being among Sepoys. On the 22d of November, the companies most severely attacked were moved out of camp, and by the 28th the whole regiment, families and followers had left the lines. These quarters were then disinfected by washing with perchloride of mercury solution, whitewashing, and removal of tiles from the roofs. During this transition period 15 persons were seized, 6 of them being Sepoys. In the ten days following removal from camp, 13 Sepoys and 20 among the families and followers were attacked. Then removal from the infected quarter had its usual effect; the cases gradually became fewer, and ceased by the end of the year. The following table summarizes the events of this period, i. e., 12th of November to 31st of December, 1897:

Among Sepoys, 34 cases, with 22 deaths = 64.7 per cent mortality.
Among women, 20 cases, with 10 deaths = 50.0 per cent mortality.
Among children, 16 cases, with 9 deaths = 56.25 per cent mortality.
Among followers, 8 cases, with 8 deaths = 100.0 per cent mortality.

Total, 78 cases, with 49 deaths = 62.8 per cent mortality.

An officer of the Plague Research Laboratory was sent to Belgaum, and commenced operation there on the 24th of December. No difficulty was experienced in persuading the men to consent to inoculation; and all the Sepoys who were off duty that day in the Hindalgi camp (229) were operated on during the morning, and allowed to return to their lines next day. Those in other camps and the families were speedily inoculated and allowed to return also. The return was complete by the 30th of December. A few more inoculations continued to be done up to the 6th of January, 1898, among followers and children, but the regiment was practically a completely inoculated community by the end of the year. The total operated on was 1665 out of a population of 1746 living in the lines at that date. The 81 not operated on were infants, women far advanced in pregnancy, and the sick in hospital.

After this date two cases occurred in January, the sufferers being a European officer and a Sepoy, both employed in disinfection work in the town; they had both been inoculated and both recovered. No cases were reported for the next 6 months, though, as shown above, the epidemic was at its height in the neighboring city and cantonment in January, and the men were allowed to go to these places freely after inoculation. That this practical immunity of the regiment was not due merely to the disinfection of the lines will be manifest to anyone studying the occurrences during the second epidemic from July to December, 1898, now to be described. The second epidemic in Belgaum town began in June, reached its height in October, and thereafter declined till January, 1899, when it ceased. The table given shows the number of deaths from plague (the attacks were, of course, many more, but no accurate figures are forthcoming on this head) reported in the city and cantonment, month by month, contrasted with the attacks and deaths in the regiment:

Dates.	Deaths reported from City and Cantonment.	Attacks in the Regiment.	Numbers of those attacked in the Regiment, who died.
June, 1898	14	..	..
July, 1898	215	1	1
August, 1898	304	2	1
Sept., 1898	698	2	1
Oct., 1898	999	4	2
Nov., 1898	275	2	1
Dec., 1898	65	1	0

From the above it is manifest that the numbers attacked and the subsequent fatalities in the regiment kept pace exactly with the severity of the epidemic in the neighboring town, rising and falling with it. The conclusion is therefore inevitable that the same infection that was producing such havoc in the civil population was equally present in the lines of the military, yet they suffered in proportion 22 times less at the height of the epidemic. In the city and cantonment, 257 persons died of the plague, or 1 in every 17 of the population, while in the Sepoy lines, with a population of 1801, but 6 died, or at the rate of 1 in every 300 only. It has been shown how heavily the regiment suffered during the first epidemic; why, then, did they not again produce cases to the same extent during the second and more severe visitation? Some sanitary measures were taken by the authorities during the epidemic in placing the cantonment and city "out of bounds" for the troops, and disinfecting the few huts that became infected, but these proved totally inadequate to stay the ravages of the disease.

A very practical answer to this question was given by the Sepoys themselves, who volunteered to undergo a second inoculation, which was duly carried out in July and August. Practically no one was left in the lines unprotected by inoculation, so that a comparison cannot be made with an unprotected population living in precisely similar circumstances, as was possible in the first experiment in the By-

culla Jail, yet, in the opinion of the Sepoys and their officers, there is no doubt that inoculation rendered them entirely immune.

There is one indirect danger which has been realized in connection with immunity, i. e., the protected, feeling themselves safe, have gone freely among the plague-stricken, and then have attended to their various occupations, and in this way have spread infection.

In summing up the benefits of the prophylactic we may say: 1st. It renders a person immune for 3 months.

2d. It acts within 24 hours.

3d. When inoculation is given in incubation stage of disease, that is, before signs of plague appear, it has, in many cases, the power to abort the disease.

4th. Inoculation has no effect on other diseases, except, possibly, eczema, which appears to be benefited by it.

5th. Inoculation confers a high degree of immunity and greatly reduces the number of plague attacks.

6th. When, in spite of inoculation, a person is attacked his chances of recovery are greatly increased.

PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

Monday, January 19, 1903.

The meeting was called to order by Dr. Osler.

Exhibition of Specimens: Intussusception, Tuberculosis of the Kidney, Carcinoma of the Kidney, Hydronephrosis of the Kidney and Hematoma of the Abdominal Wall. DR. CULLEN.

DISCUSSION.

DR. OSLER.—Dr. Cullen is to be congratulated on such a brilliant series of surgical cases. The case of tuberculosis of the cæcum is, I think, the first to be shown here illustrating that remarkable type of local intestinal tuberculosis which has been attracting so much attention of late, namely, a hypertrophic colitis, simulating tumor and which when found at autopsy or at a surgical operation may be mistaken for a tumor because of the solidity, firmness and the apparent absence of the ordinary features of tuberculosis. It is interesting too as showing how far the condition may progress without any of the usual features of tuberculosis; there were no ulcerations and no tubercles on the surface and yet histologically it was a true tuberculous process.

I would ask you to contrast the hydronephrotic kidney with the cystic kidneys which I demonstrated at my clinic on Saturday last. The conditions are totally different, this being due to some structural trouble in the early years of life resulting in a gradual distension of the calices with complete destruction of the organ.

Exhibition of Cases. DR. RANDOLPH.

DR. RANDOLPH.—The cases which I have to show this evening are all of the same character, cases showing the results of recent operations to recover pieces of steel from the back of the eye. The first mention of the magnet being used for extraction of steel from the eye is recorded in 1874. At that time the ordinary magnet such as you are all familiar with was employed and an incision was made in the sclera to extract the foreign body. In 1879, Hirschberg invented the electro-magnet such as the one you see before you. This instrument was used until 1893, by most ophthalmic surgeons but it must be remembered that a magnet of this size is nothing more than a magnetic probe, that is to say the point of the magnet if not brought in contact with the foreign body must at least be brought very near it. A great advance in this class of operations was made in 1893, when Professor Haab of Zurich, introduced the giant magnet. With his instrument it is not necessary to see the foreign body. It is a very large instrument weighing 200 pounds, and the patient has to be brought close to the magnet and if there be a foreign body in the eye an impulse forward is noted and the patient feels pain. The great disadvantage in these large magnets, however, is the danger of injuring parts of the eye which were uninjured previously by the foreign body. The object is to draw the foreign body from the back of the eye into the anterior chamber and then to extract it from this point but the foreign body is apt to take the most direct route to the magnet which is often through the iris and hence the danger of drawing pieces of steel through uninjured parts of the eye.

These considerations induced Lippincott, Johnston and Sweet to modify the magnet and to use it in connection with the X-ray apparatus. The magnet made by Sweet is the one we employ here and it has been found adequate to these operations. It is not nearly so large as the Haab magnet, weighing only about 35 pounds, but has a lifting force of 78 pounds. I take this opportunity to thank Dr. Sweet of Philadelphia, for the work he has done in connection with these four cases. His method of localizing pieces of steel in the eye seems to me absolutely accurate and in every case he has located the foreign body exactly where it was subsequently found. The foreign body is not pulled blindly forward, but located, after which an incision is made through the sclera near the spot and the magnet is brought close to this opening. In one of these cases the piece of steel was very near the optic nerve and the magnet had hardly reached the eye when the foreign body jumped out of the wound. All of these patients came to me since June, and all were from the Baltimore and Ohio Railroad shops. They all show the value of extracting the foreign body as soon as possible after the injury. For instance, the first case was operated upon on the third day and he has the best vision of the four. The next case was 18 days old and his vision is practically gone but still he has the eyeball and when one thinks that not long ago such eyes were doomed to enucleation he can see the great advance in this domain of ophthalmology. The

third case has only light perception, while the fourth whose foreign body was removed on the fourth day will have useful vision. Haab has recently reported 165 cases of removal of pieces of steel from the interior of the eye-ball and of these 55 recovered useful vision. The method, then, in many cases saved sight and in many more preserved at least a sightly eye-ball.

Report on the Prevalence of Uncinariasis in the Southern States. Illustrated with Stereopticon Slides. Dr. Stiles.

An account was given of a trip made through several Southern States to study this disease. It was found that Uncinariasis existed in North Carolina, South Carolina and Georgia, and the following conclusions were reached: 1. It is pre-eminently a disease of the sand-hills. 2. Cases occur in groups and several members of the family are generally affected. 3. It is more severe among whites. 4. Although it occurs among adult males it is most severe among women and children. 5. The danger of infection is greater in the summer, as a freezing temperature is fatal to the eggs and embryos. 6. Miners, farmers, brickmakers and their families are most frequently affected.

Discussion.

Dr. Osler.—I am sure we all feel deeply indebted to Dr. Stiles for this most interesting lecture on subject of such natural importance, and we can congratulate him on a most brilliant piece of clinical work. It is very gratifying to think that it was done by a member of the Marine Hospital Corps, to which we are indebted for so many important studies in hygiene and epidemiology.

I do think these facts should be brought before the physicians and the educated people throughout the South so that the matter can be brought home practically to these unfortunate sufferers. This work of Dr. Stiles will have important economic results and be the means of relieving a large class of people.

February 2, 1903.

The meeting was called to order by the President, Dr. Williams.

Sarcoma of the Tibia. Dr. Bloodgood.

Two months ago a giant celled sarcoma was removed from the medullary cavity of the upper part of the tiba and since the operation I have examined the granulation tissue which has grown from the bone cavity, and find no evidence of any cells similar to those in the tumor. At the last dressing, two or three days ago, I found that all of this red granulation tissue which you see lining the bone cavity was infiltrated with bone.

In the clinical history this case illustrates very well the character of this form of sarcoma, the least malignant of bone tumors, and also illustrates the connection between trauma and bone tumors. Some nine years ago there was an injury to this bone and ever since that time the patient has felt some tenderness and at times pain in the head of the tibia. He did not notice any swelling until about three years before coming under my observation. It was difficult then to make out a swelling, but the X-ray photograph showed a lighter shadow in the upper end of the tibia than in the normal bone. At below the operation the tumor looked like very hæmorrhagic granulation tissues and could be peeled from the shell of bone without any difficulty. Of course we used the curette and chisel as much as possible to get beyond the bony growth and I think it safe to say that this is normal granulation tissue filling the cavity.

Exhibition of Two Cases of Radicular Paralysis of the Brachial Plexus. One from the Pressure of a Cervical Rib with Operation. The Other of Uncertain Origin. Drs. Thomas and Cushing.

Dr. Thomas.—*Case I.*—The first patient (Dis. Nerv. Syst. No. 13,222½, Hosp. Surgical No. 13,651) which I present to you to-night has interested us very much on account of the difficulty of diagnosis and of the number of opinions that were held concerning the condition which caused her trouble. She was sent to the Neurological Dispensary in April of last year. She then gave the history of having suffered a great deal from pelvic trouble, subsequent to the birth of her child, which took place when she was 16 years old. She was treated at the Hospital of the University of Maryland, and I believe that both tubes and ovaries were removed, for an inflammatory condition, said to have been due to a gonococcus infection. Since this time she had suffered from various nervous symptoms, fainting attacks, and the like; but nothing of very serious moment. Three months before she came to us, she, however, began to have intense pain in the right arm. This pain was paroxysmal in character and seemed to shoot down the ulnar side of the arm, and was so severe that it incapacitated her. The arm had become weak and the muscles of the hand had begun to atrophy. She also complained that the leg on the same side was somewhat weak .

Upon examination we found a healthy looking young woman of 19 years of age, who did not appear markedly neurotic. The whole right arm was weak, but this weakness was most marked in the intrinsic muscles of the hands, and these muscles showed evident atrophy. The electrical examination showed the reaction of degeneration in the small muscles of the hand, but the other muscles all acted normally. At first we did not discover any disturbance of sensation, although we tested for it. This I am now inclined to believe was a mistake, as on later examinations a very definite area of anæsthesia was discovered. This area occupied the ulnar aspect of the forearm and extended somewhat above the elbow. It involved touch, pain and temperature. We were at first inclined to regard her trouble as a localized neuritis and she was treated for the relief of this condition. She was given electricity daily and appropriate internal medication. There was, however, no improvement in her condition and the pain was so severe in character as to suggest strongly that it was due to irritation of the spinal root; and, as she complained more and more of weakness of her right leg, we began to suspect that there might be an intraspinal growth pressing upon the spinal cord. Upon testing, it was found that the whole right leg was quite weak; the deep reflexes were active, although not more so on the right

than on the left. There was, however, a definite dulling in her perception of pain and temperature over the right leg, and right side of the trunk. In spite of the fact that the disturbance of sensation was on the side of the supposed lesion, instead of on the opposite side, I felt that there was probably some central trouble, and she was admitted to the surgical ward under the care of Dr. Cushing, who had seen the case with us on different occasions in the dispensary. He thought he could make out by palpation the presence of an extra cervical rib; this was confirmed later by the X-ray picture. These findings, of course, threw doubt upon the diagnosis of a central trouble, but as the presence of a cervical rib could not explain the symptoms referable to her leg, there was still some uncertainty. While she was in the hospital it was possible to examine her more carefully and we then discovered that the disturbances of sensation, which were present on the right leg, extended over the whole right side of the body, including the head. It was quite easy to distinguish the area of absolute loss of sensation on the inner aspect of the right arm from the general lowering of sensibility throughout the whole side. The weakness of the right leg involved all the muscle groups and did not have the selective quality so characteristic of involvement of the pyramidal tracts. Dr. Cushing also demonstrated areas of more definitely disturbed sensation over the chest, which could not be determined at other times. These facts, taken with the history of convulsive attacks and other neurotic manifestations, made it evident that we had to do with the combination of a definite local lesion (pressure on the lower part of the brachial plexus from the cervical rib) and a functional or hysterical condition. Dr. Cushing, as I hope he will tell you, removed the rib, and since then the patient has been entirely relieved from the intense pain, and there is improvement in sensation in the area over the ulnar aspect of the arm. She still has hysterical manifestations from time to time. As you will see, however, the muscular condition of the arm has not changed, and the electrical condition is just as it was before the operation.



RADIOGRAPH OF CASE I.
SHOWING RUDIMENTARY CERVICAL RIBS.

Dr. Cushing.—There is little to be said concerning the operative features of this case, its chief interest, as Dr. Thomas has pointed out, having centered in the question of diagnosis.

The anatomical distribution of the symptoms in the right arm, namely, the radiating pain along its post-axial border, the area of anæsthesia in the cutaneous distribution of the ulnar and the atrophy of the intrinsic muscles of the hand, all indicated a lesion of some sort involving the lower cord of the plexus or the root of the first dorsal nerve. With the patient's head in a lateral position, a distinct and what seemed to be a bony resistance could be made out on deep palpation over one point in the right supraclavicular triangle. There was considerable tenderness at this point and pressure caused pain, akin to the patient's spontaneous pain, to shoot down along the inner side of the arm. There was no undue prominence of the subclavian artery.

The radiograph, which Dr. Deetjen was kind enough to take for us, clearly demonstrated the presence on the right side of a bony projection, 2 or 3 cm. long, extending from the transverse process of the 7th cervical vertebra. The shadow from a corresponding but even less well developed process was evident on the opposite side (cf. Radiograph, Case I).

Thus the suspicion that a rudimentary cervical rib might be the cause of the radicular symptoms was fortified and it seemed presumable that the hemilateral lowering of sense perception on the trunk, which Dr. Thomas has described, was of a functional nature and merely superimposed on symptoms due to a definite organic lesion.

The operative procedure was a simple one. By reflecting a curved skin flap, the contents of the posterior cervical triangle were brought into view and it was found that the lower cord of the plexus was compressed by a dense fibrous band which passed from the tip of the rudimentary rib under the plexus to its point of attachment on the first thoracic rib. This band, therefore, representing the continuation of the rudimentary rib and over which the lower cord of the plexus arched at rather an acute angle, was the offending agent rather than the bony projection itself. The band, together with the cervical rib, was excised, precautions being taken in the procedure to avoid the great vessels and the underlying dome of the pleura. These structures have oftentimes been injured in the attempt to remove cervical ribs in case the latter have been more developed than the one in our case. The precaution was taken also not to shell the rib out of its

periosteal sheath, but to remove the structure in its entirety in order to insure no subsequent new formation of bone.

The functional hemi-hypæsthesia disappeared at the time of operation; at all events, no disparity in the cutaneous sensibility on the two sides of the body could be made out on the following day, nor on later examinations. There was likewise an immediate relief to the patient's subjective radiating pain and since the operation the area of ulnar anæsthesia has gradually disappeared. As Dr. Thomas has stated, there has been no restoration of motion in the paralyzed muscles and it seems quite probable that this may only be regained by a nerve anastomosis between the ulnar and median nerves. It is interesting to note that Borchardt before the *Berliner medicinische Gesellschaft* about a year ago reported the case of a patient with a cervical rib in whom a hyperæsthesia of the entire right side of the body coexisted with sensory and motor symptoms in the arm. Oppenheim in the discussion of this case attributed this hemilateral sensory disturbance to the presence of a spinal gliosis, pointing out that the supernumerary rib and the gliosis were both congenital anomalies and might naturally appear in the same individual. He had seen another patient with a cervical rib, in whom there were associated hysterical symptoms similar to those which Dr. Thomas has described in this case.

Dr. Thomas.—*Case II.*—The other patient (Hosp. Surgical No. 14,310, Dis. Nerv. Sys. No. 14,162) whom I wish to show you is particularly interesting on account of the similarity of her condition to that which you have seen in the first case. She is from the South, and came to the hospital complaining of a crippled hand. She is now in the surgical wards of the hospital under Dr. Cushing's care, and he has asked me to present the case. She is a young woman of 21 years and a milliner by occupation. She gives an excellent family and personal history, except that when she was about seven years old she had a curious attack of weakness of the right arm. This trouble, she says, came on suddenly while she was carrying a heavy umbrella. Her arm gave out and became practically useless. There was no pain or any other symptom except that she remembers having had a swollen face at the time. The weakness in her arm gradually got better and in two months she thinks she was quite well. The arm gave her no more trouble until the beginning of her present attack. She used it for everything and does not think that it was any smaller than the other. About three years ago she began to notice that the right arm was weak and that it tired after any continued effort. This gradually increased and the muscles of the hand began to waste. There was no pain in the arm and the only sensory symptoms were that the hand felt numb and cold more often than the other. During this last winter the condition has gotten so much worse that she has been unable to use the hand in sewing for several months.

As you see, the patient is a remarkably strong, healthy looking girl. She has shown no signs of a neurotic temperament. All the cranial nerves act normally and, indeed, there is no abnormality other than the condition of the right arm. The muscles moving the shoulder-joint all act well and flexion of the elbow is strong, although perhaps a little weaker than on the left side. Extension of the elbow is quite weak. Below the elbow the muscles show very little power. In flexing the wrist, you will notice that the tendon of the flexor carpi radialis stands out prominently, and this muscle shows a fair amount of strength. When the wrist is extended, or, more properly, dorsally flexed, and I make effort to straighten it, you will see that the ulnar side gives way, showing that here, too, the muscles on the radial side are stronger. She can just flex her fingers, but with very little power. She can extend the thumb, index and little fingers, but here too the power is slight. The power of extension of the two middle fingers is still weaker. The intrinsic muscles of the hand are all extremely weak, most of them, indeed, entirely paralyzed. The right arm is, in general, smaller than the left. Above the elbow this is not so marked, the difference of circumference being a little more than one cm. Below the elbow it is from two to two and a half cm. smaller than the left. There is marked atrophy of the intrinsic muscles of the hand. There is some slight contracture in the fingers, showing the beginning of the claw-hand position. There are no marked trophic changes in the fingers. The nails are smooth, but are perhaps a little more curved laterally than those of the left side. No fibrillary tremors are to be seen.

Sensation, when tested with a light touch of the finger, shows no abnormality; if, however, it be tested with a horse-hair, it is found that there is an area of disturbed sensation which occupies the ulnar border of the forearm, extending somewhat above the elbow and taking in the ulnar aspect of the hand. In this area the patient often does not appreciate the slight touch of a hair and does not feel a sharp point, as sharp. We were unable to determine any abnormality in her perception of heat or cold. She seems to appreciate equally well on the two sides.

The deep reflexes are interesting. There is an active biceps jerk, but practically no triceps reflex, whereas on the left side it is excellent.

Electrical examination shows very marked changes. There is practically no response when the nerves at the elbow are stimulated. The flexor carpi radialis is an exception to this. A strong faradic current applied directly to the muscles of the forearm causes very little result, and the intrinsic muscles of the hand cannot be made to respond. It is quite remarkable that in muscles which still show voluntary power there should be no faradic response. To the galvanic current there are various degrees of the reaction of degeneration.

Pressure in the plexus above the clavicle on the left side gives no particular discomfort, while on the right it causes a tingling, uncomfortable feeling which runs down the inner border of the arm to the fingers.

A solution of cocaine put into the eyes dilates the pupils equally.

The similarity in the condition of these two cases is, as you see, quite marked, and having them under treatment at

the same time, it is natural that we should look for a common cause. In this patient nothing can be discovered by palpation and Dr. Cushing tells me that the excellent X-ray pictures which have been taken in the hospital by Dr. Baetjer do not show the presence of an extra cervical rib. Although the similarity in the condition of the hands of the two patients is striking, in certain other respects the cases differ widely. In the first patient, the degenerative paralysis is limited to the intrinsic muscles of the hand; and the general weakness of the arm, with normal electrical reaction of the muscles, is, I believe, to be associated with her other hysterical manifestations. In the second case, the muscular defect is more widespread, involving, besides the intrinsic muscles of the hand, the muscles of the forearm, the radial muscles being less affected than the others. The triceps group is also very weak and the triceps reflex is lost. There is marked electrical change in all these muscles. The most striking difference, however, is the complete absence in the second case of any pain, which is such a prominent feature in the first. The objective sensory disturbance is also much more definite in the first than in the second case. The condition of the first patient is well explained by a lesion, which irritated and paralyzed the first thoracic nerve on its way to the brachial plexus, and, as Dr. Cushing has told you, the operation revealed such a condition. In the second case the muscles which are affected are principally represented in the first thoracic and eighth and seventh cervical spinal nerves. Those muscles which are less affected, the radial extensors and flexors of the wrist, are, together with the flexors of the elbow, represented somewhat higher in the plexus, and, to explain the condition, we must think of a lesion affecting these three spinal nerves, or the spinal cord at the level from which they arise. The absence of all spontaneous pain, which is such a prominent symptom in lesions of the spinal root, makes it hard to think of such a cause; and the disproportion between the objective sensory disturbance and the motor paralysis speaks against a destructive lesion of mixed nerves. In this connection the article by Farquhar Buzzard (Brain, Summer, 1902) is of interest. He reports six cases of paralysis of the arm, due to what he assumes to be some vascular disturbance in one or more of the roots forming the brachial plexus. The condition in one or two of his cases is quite similar to that seen in our second case. Buzzard has no pathological observations to support his view. If we assume a central trouble to explain our patient's condition, there are two possibilities which seem to me to be worthy of consideration; the first, the presence of syringomyelia, or an analogous condition; and the second, a progressive degeneration in the anterior horns, following an old acute trouble, which may have caused the sudden paralysis of the arm when the patient was a child. There are difficulties in the assumption of either of these views. I feel that at present an absolute diagnosis is not possible, and that we must wait for further developments.

Dr. Cushing.—Unusual cases are proverbially apt to appear in duplicate, and I may have been influenced by this tradition when I admitted this second patient into the hospital with a presumable diagnosis of a cervical rib. There was a distinct point of tenderness over the plexus on the right side, pressure on which, as in the former case, caused a sensation of numbness and tingling to extend downward along the ulnar border of the arm. The sensory and motor symptoms, although more extensive than those in the first patient, I nevertheless thought could have been occasioned by pressure against the lower part of the plexus, involving more than the single first thoracic trunk. The radiograph, however, has shown nothing more than an unusually well developed transverse process on each side of the seventh cervical vertebra, and no distinct indication of a rudimentary rib. It is, of course, not impossible that a fibrous band representing such a rudimentary rib and casting no shadow from the X-rays might be the cause of such a pressure palsy, for it is well known that in cases of cervical rib the symptoms occasioned thereby are by no means proportionate to the degree of development of the bony process. Thus a very small rudiment, as in our first case, may be provocative of severe symptoms for which the fibrous prolongation of the bony process under the plexus may be alone responsible. Luschka, moreover, in his description of these rudimentary ribs has classified them in three groups, in one of which the bony process does not extend laterally beyond the tip of the transverse processes of the seventh vertebra.

The careful examination which, under Dr. Thomas' direction, has been given this patient has shown that several other diagnostic possibilities are present, and in the absence of any subjective discomfort on the part of the patient this has seemed to render operative exploration inadvisable. The patient, furthermore, has improved under a general rest treatment with electrical exercises for the muscles.

Although an absolute diagnosis in this case must remain undetermined, the similarity in the clinical picture of the two patients before you cannot fail to be somewhat suggestive, and they have been presented together chiefly for the purpose of emphasizing the fact that pressure from a supernumerary cervical rib must always be borne in mind as a possible causal agent in palsies of this type. In two recent articles, which have dealt with the subject of radicular palsies, one by Duval and Guillain, from Raymond's Clinic, and the other by Buzzard, which Dr. Thomas has quoted, no mention was made of a cervical rib as an etiological factor in their production. One of two of Buzzard's cases are not at all dissimilar in their description to these patients before you.

From an anatomical standpoint, instances of cervical rib are not exceedingly uncommon, and indeed reports of this anomaly are to be found in very early medical literature.[1]

[1] Sir Thomas Browne in his Pseudodoxia Epidemica or Commentaries on Vulgar Errors (Second Edition, London, 1650, p. 292) speaks of the heated discussion over the biblical story, which arose from the description by Columbus of a female skeleton which possessed a supernumerary rib.

"That a Man hath one Rib lesse than a Woman, is a common conceit derived from the history of Genesis, wherein it stands delivered, that Eve was framed out of a Rib of Adam; whence 'tis concluded the sex of Man still wants that rib our Father lost in Eve. And this is not only passant with the many, but was urged against Columbus in an Anatomy

Mr. Brush has recently reported in the BULLETIN a study of three cases which were found among the material in our own Anatomical Department. When one considers, however, that but a small percentage of the individuals possessing this abnormality have any symptoms referable thereto, it can be seen that the clinical cases with symptomatic disturbance from this cause are in reality quite rare. The cases, furthermore, in which these symptoms have been sufficient to call for operative intervention and excision of the rib are still more uncommon. I know of no recent article in which a report of the collected cases has been made. In 1895 and 1896 several papers appeared on this subject and at that time there seem to have been only ten or twelve instances of the operation which had been mentioned in medical literature. Borchard in 1901 had cognizance of only sixteen cases.[2]

There may be great variation in the symptoms which are occasioned by the presence of such an anomalous rib. Oftentimes it may give no indication of its presence whatever and a chance examination only may have led to its detection. In case the rib is a well developed one, however, the abnormally high position of the subclavian artery and the unusual bony prominence which can be palpated beneath it will have attracted attention to its presence. In such cases there may be serious vascular complications. In some individuals, as in the patients before you, disturbances from pressure on the plexus may be present. These may be transient in their appearance and only be produced by fatigue or by certain postures which tend to augment the tension of the plexus. Symptoms may, on the other hand, be more or less persistent. In some cases the symptoms are simply those of slight paresthesia; in other cases, pain of a radiating character may be produced, but it ordinarily is absent; in others, motor palsy is most apparent and it may be even more advanced than in this second patient which Dr. Thomas has shown. Occasionally, symptoms may begin at an early age. As a rule, however, they are for one reason or another postponed until adult life. Certain occupations which necessitate the carrying of heavy weights may by putting the plexus on the stretch suddenly precipitate symptoms in patients in whom they were previously latent. Thus de Quervain, for example, has pointed out that the musket drill has produced paralytic symptoms in young recruits from this cause, the presence of a cervical rib having been previously unsuspected. It will be remembered by many here that a recent member of the Hospital Staff, who was particularized by the presence of a cervical rib, made a careful study of the selective sensory disturbances which were occasioned thereby in his own arm. The results of this investigation were reported in the first number of the Journal of Experimental Medicine. In this case a fully developed cervical rib had produced relatively slight symptoms and those mostly of a sensory nature. In marked contrast to this condition was the picture presented by the first patient this evening, in whom a very rudimentary bony process had been productive of symptoms severe enough to incapacitate her to a great extent on account of pain and also to lead to what seems to have been a destructive lesion of the motor neurones of this lower cord of the plexus.

of his at Pisa; where having prepared the sceleton of a Woman that chanced to have thirteen ribs on one side, there arose a party that cried him down, and even unto oathes affirmed, this was the rib wherein a woman exceeded. Were this true, it would autoptically silence that dispute out of which side Eve was framed; it would determine the opinion of Oleaster, that she was made out of the ribs of both sides; or such as from the expression of the Text maintain there was a plurality required, and might indeed decry the parabolicall exposition of Origen, Cajetan, and such as fearing to concede a monstrosity, or mutilate the integrity of Adam; preventively conceive the creation of thirteen ribs."

[2] Berliner klin. Wochenschrift, 1901, Bd. 38, p. 1265.

The Use of the X-ray in Surgery. DR. CODMAN, of Boston.
See May Bulletin, 1903, page 120.

The Physics of Radiography. PROF. AMES.

February 16, 1903.

The meeting was called to order by Dr. Hurd, in the absence of the President.

Absorption of Granular Material from the Peritoneum. DR. MACCALLUM.
See May BULLETIN, 1903, page 105.

Traumatic Pericarditis, Endocarditis and Myocarditis. DR. PLEASANTS.
See May BULLETIN, 1903, page 124.

Giant Cell Sarcoma of the Bone. DR. BLOODGOOD.
See May BULLETIN, 1903, page 134.

March 2, 1903.

The meeting was called to order by the President, Dr. Williams.

A Case of Angioneurotic Œdema. DR. BLOODGOOD.
See May BULLETIN, 1903, page 138.

DISCUSSION.

DR. OSLER.—These cases seem scarcely to belong to the ordinary type of angioneurotic œdema in which the œdema is singularly transient. No doubt there are instances with marked hyperæmia, of which this seems to have been a striking illustration. Those troublesome and disfiguring cases of the angioneurotic œdemas of the eyelid, will no doubt now be treated surgically.

Had this patient any colic?

DR. BLOODGOOD.—Yes.

A Clinical Summary of Fifty Cases of Summer Diarrhea. DR. KNOX.

The mortality among young children is largely due to diarrheal diseases, a large part of which occur during the summer. The Thomas Wilson Sanitarium was built for the treatment of such cases, and every summer 300 to 400 cases of intestinal disorders receive treatment there. Dr. Booker's important work on the bacteriology of the diarrheas of chil-

dren was done there. The recent revival of interest in the subject has been due to Dr. Flexner's stimulus and co-operation.

Clinically, there are many classifications of summer diarrheas, all of them being more or less unsatisfactory. Two divisions, however, are useful to recognize—(1) gastro-intestinal catarrh, in which toxic symptoms predominate; (2) ileo-colitis or colitis, in which there is follicular ulceration.

In the first group there is malaise, food is refused, nausea and vomiting come on, there is fever of varying degrees; then the diarrhea begins, the stools being semi-fluid or fluid, containing more or less mucus, and sometimes tinged with blood. Microscopically, they contain epithelium, pus, and a few red-blood corpuscles. The fulminating type is called cholera infantum. In this the toxic symptoms are intense, there is great constitutional breakdown, with high fever, clammy extremities and serous stools, the patient passing into stupor, then becoming comatose, and dying before many hours have passed. There are cases in this group which become subacute or chronic, lasting for a considerable time. These are the so-called cases of intestinal indigestion, which have occasional exacerbations and gradual loss of weight.

Pathologically, the cases are characterized by absence of lesions, the intestines are pale and contain catarrhal exudate, which is seen microscopically to consist of red and white blood corpuscles and epithelial cells. Occasionally there is an adherent membrane, with spots of ecchymosis in the ileum or colon. Peyer's patches and the mesenteric glands are swollen.

In the second group the symptoms may be similar. The onset is often acute, the symptoms being those of an acute catarrhal inflammation as before, but there is soon destruction of tissue. Localizing symptoms are prominent, there is much colic and tenesmus, and wasting is marked. The stools soon suggest ulceration, blood being present in large amount, often mingled with pus. The cases may, however, become chronic, and are then very tedious. Complications may arise, such as hydrocephalus, or a peculiar subcutaneous hardness, due to loss of fluid from the tissues. About one-third of the cases belong in the first group, the remainder in the second.

A striking fact was that in thirty of the cases unboiled water had been used either for diluting the milk or for cleaning the feeding bottle, and as it is known that there are frequently millions of bacteria per cubic centimeter in unboiled water in the summer, it is easy to imagine that the original infection may have often come from the water. Soiled linen was doubtless one channel of infection. One case developed diarrhea while at the Sanitarium, although receiving pasteurized milk and boiled water between feedings. The infection was probably carried by flies.

Treatment.—In cases seen reasonably early, the bowels are emptied by a purge, milk is withheld as long as possible, stimulation is used as needed.

In conclusion, it may be said that (1) diarrhea in children due to the B. dysenteriæ cannot be differentiated from ordinary summer diarrhea. (2) The discovery of the cause is the first step towards providing a remedy. One method of prevention will certainly be the provision of a plentiful supply of pure milk for those who cannot get it themselves. (3) The agglutinative reaction must be the means of diagnosis for the clinician. It will be especially useful in cases with a slight onset. (4) Disinfection must be thoroughly practiced. (5) Early diagnosis by laboratory methods makes the treatment more easy.

The Bacillus of Dysentery, with Special Reference to its Etiological Relationship to the Summer Diarrhea of Children. Dr. Flexner.

In 1898 Shiga reported his studies of Japanese dysentery in the *Centralblatt für Bakteriologie.* He had already published preliminary reports in Japan previously. In order to be sure that the organism which he described was etiologically concerned, Shiga used an agglutinative test. All previous descriptions had failed to mention control tests. The bacillus described by Ogata, for example, was merely peculiar in its characteristic. Still another bacillus was found to be merely pathogenic to animals. These qualities, however, could not serve as criteria, and Shiga's use of an agglutinative reaction was the first definite work in that direction. He fails to receive due credit from German writers. Not all dysenteries are due to the Shiga bacillus. The amebic type, for example, is apparently an independent infection, although in some cases of amebic dysentery there may be a previous or a subsequent bacillary infection. Epidemics of dysentery are, however, doubtless all due to the Shiga bacillus. Local outbreaks and many of the sporadic cases are likewise due to the same organism. In spite of Kruse's suggestion that institutional outbreaks of dysentery are more likely to be due to pseudo-dysenteric organism than to the Shiga bacillus, Vedder and Duval found only the Shiga bacillus concerned in outbreaks of institutional dysentery in New Haven, Conn., and Lancaster, Pa. In the United States, therefore, it is reasonable to infer that the institutional cases, as well as many of the sporadic cases, are due to this organism.

The organism is like the B. typhosus, and may be easily confounded with it. Chemically, their action is very similar, but B. dysenteriæ is not motile, and its agglutinative reaction serves to differentiate it. The question of its motility is an interesting one. Shiga's first report and my own early observations agreed that the organism was motile. In 1901 Kruse reported a small epidemic, ignoring the work done by Shiga and the Johns Hopkins Commission, and said that B. dysenteriæ was non-motile. Vedder and Duval failed to find motility, but succeeded in staining flagella by Van Ermengem's method. Later, at the Thomas Wilson Sanitarium, Bassett and Duval proved that the organism was motile, but only under certain conditions. If it be passed through guinea-pigs, transplanted to bouillon, then to second bouillon, the transfers being rapidly made, a rapid motility can be made out which quickly disappears. Similar difficulty was experienced in determining the motility of B. coli during the earlier

studies. Perhaps in nature the Shiga bacillus is motile, but in cultures this is quickly lost. The presence of flagella proves probable motility. In some epidemics B. dysenteriæ has not been isolated, but this failure can be readily explained. The method of isolation is described fully in the Journal of Experimental Medicine, 1901. The most important recent contribution on the subject is the study made at the Thomas Wilson Sanitarium in the Summer of 1902, the Shiga bacillus being found there in the stools of forty-three cases. The number of bacilli present varied with the nature of the stools, most organisms being found in the bloody portions and the next largest number in the mucous portions, comparatively few being present in the solid portions. The etiological relationship of the organism is proved by the agglutinative reaction, which may, however, be delayed or fail altogether to appear. It is most useful in cases where it appears early. If it appears late, it may not be possible to use the antidysenteric serum with success. It is safe, however, to assume that as many as forty-three out of fifty cases of summer diarrhea are due to the Shiga bacillus. There is probably some slight difference in organisms isolated in various cases. The agglutinative reactions are somewhat irregular, as also are the chemical reactions in sugar media. For instance, all form acid, but no gas, in glucose media, while only some of the cultures form acid in mannite. This suggests that we are probably dealing with a group of organisms rather than with a single species.

The results with protective serum will be followed with interest. In 300 cases recently studied Shiga tried this and found it of definite use. Kruse published a paper more recently and ignored Shiga's work. Horses are being at present immunized in Philadelphia against the B. dysenteriæ, the cultures which are used being of such virulence that 1 mg. will kill a guinea-pig weighing 300 grammes. The serum thus prepared will definitely protect guinea-piggs, and it will be tried on a large scale in human cases next summer. By immunizing animals with various strains of the organism it can be determined whether there is any cross-protection. There doubtless is such protection, but a large amount of serum is required.

To summarize: (1) The acute dysentery of adults and the summer diarrhea of children are due to the same cause, *i. e.*, the B. dysenteriae of Shiga, the organisms having definite group characteristics; (2) Immunization against the organism is possible and the outlook for a protective serum is good.

Discussion.

Dr. Welch.—We are all indebted to Dr. Flexner for the extremely interesting and clear account which he has given of the investigations of Shiga's bacillus and its relations to dysentery and infantile diarrhœa. It cannot be doubted that these investigations are of great value, and have already shed much light upon the etiology of an important group of diseases. As Dr. Flexner has pointed out, there remain a number of problems needing further study. Further information is needed concerning the prevalence and distribution of Shiga's bacillus and allied bacteria not only in diarrhœal diseases of infants and adults, but also in other diseases and in healthy persons and in external nature. Just at present one of the most urgent problems is the precise determination of the cultural and other characters which belong to Shiga's bacillus or to the Shiga group of bacilli. Recent studies, especially those of Martini and Lentz and of Hiss and Russell, have led to the recognition of a group of bacteria resembling closely the original bacillus of Shiga, but differing from it by certain cultural and biological characters considered by these investigators sufficient to separate the former bacteria from the genuine bacillus dysenteriæ. It is, therefore, contended that without more refined methods than those commonly employed in the earlier investigations, various species of bacteria are likely to be confounded with the true bacillus of dysentery and have in fact thus been confounded. There seems to me much in favor of Dr. Flexner's position that we must widen the boundaries assigned to the bacillus of dysentery and recognize here, as we do in the case of the colon bacillus, a group of bacteria closely allied in morphological, cultural and pathogenic properties, although not identical with each other in all respects. Thus we recognize colon bacteria which ferment saccharose and other colon bacteria which do not ferment saccharose. So it is permissible to take the position that possession of the capacity to ferment mannite, for example, does not in itself necessitate the removal of an organism from the group of the dysenteric bacilli. Then very interesting and sometimes perplexing agglutinative properties are possessed by members of this group, which would seem in general to be characterized by curious variations and differences in their receptor apparatus, well deserving careful analytical study. It is evident that considerably more work is needed before these, and kindred questions are answered to the satisfaction of all workers in this new and important field.

It is of interest, although not surprising, that Shiga's bacillus is found to be the specific agent of infection in various forms of dysentery, which had formerly been separated from each other on anatomical and clinical grounds. We are quite familiar with the circumstances that many other kinds of bacteria, such as, the diphtheria bacillus, and the pyogenic streptococci and staphylococci, may each produce affections with varying anatomical and clinical characters. While this experience is not altogether welcome to the clinician and the pathologist, it furnishes no valid argument against the recognition of the bacillus in question as the specific cause of these various affections.

Whether all forms of dysentery can be brought under one or the other of the two great classes—amœbic dysentery and bacillary dysentery—is a question. At present this does not seem to be the case. It is rather curious that, so far as I am aware, the Shiga bacillus has not hitherto been isolated from any case of dysentery in England, although it has been sought

for. Still we should bear in mind that much experience and skill are needed before we can say that a negative result in this matter is conclusive, as the isolation and recognition of Shiga's bacillus require special training.

Case of Myelogenous Leukemia with Several Unusual Features. Dr. Simon.

See The American Journal of Medical Sciences, Vol. 125, June 1903, p. 984.

March 16, 1903.

Dr. Williams in the chair.

Two Cases of Cirrhosis of the Liver in Children. Dr. Osler.

Dr. Osler.—This first child, aged seven, was admitted February 7, with the history of probable lues in the mother, who had had numerous miscarriages. The child's father disappeared some years ago. This child has had measles and whooping cough and a year ago was brought to the dispensary with enlarged glands of the neck; has had occasional attacks of bronchitis but no signs of tuberculosis. About the first of February, the mother noticed that the abdomen was enlarged and hard. There is nothing in the face, the teeth or the conformation of the head to suggest lues. On examining the abdomen it is at once seen that there is considerable enlargement in the upper region with a definite ridge midway between the navel and the ensiform cartilage which corresponds with the edge of the enlarged liver. The superficial veins are moderately distended. On palpation, the entire upper section of the abdomen is found to be filled with a hard, firm mass, everywhere smooth on the surface and nowhere painful. Just below the navel, in the nipple line, can be felt a hard, firm edge. As you get the fingers under the left lobe of the liver, you feel that it is hard, and thickened. The edge of the enlarged spleen can also be felt. There is no glandular enlargement elsewhere. The vertical area of liver dullness extends fully ten inches. There is no sign of any ascites or swelling of the feet.

The conditions with which enlarged liver in childhood is associated are tolerably numerous. Of course in very young children it is common in any condition of malnutrition; you see it particularly in rickets where it is almost the rule. Another very common cause of enlargement early in life is syphilis and this is seen both in congenital cases and also within the first year of life and it may be seen later but of course the majority of cases of infants with hereditary syphilis of the liver die within the first year. In this country and in Europe an enlargement of the liver due to cirrhosis is rare; you pass a year perhaps without seeing a single case. But in tropical countries it is exceedingly common and perhaps one of the most interesting contributions to the subject has been made by the Anglo-Indian physicians, who has shown that cirrhosis of the liver is very common. One physician, has reported, I think, nearly double the number of cases of cirrhosis of the liver in children that have been reported in the literature before. He attributes it to the absorption of the imperfect products of digestion. In a large proportion of cases in children the organ is enlarged but there is no ascites until late in the disease and there is very rarely jaundice.

Case. 2. This lad, aged 13, was admitted February 27, complaining of a swollen abdomen. There is nothing in the family history and nothing very special in the personal history. He has had measles but no other severe illness. Within the past year he has occasionally taken a few glasses of beer. For years his father thinks there has been perhaps a slight failing in health and for two or three months past he has been dull mentally but the enlargement of the abdomen came on somewhat suddenly and only a few days before admission. Since his entrance the abdomen has progressively enlarged and as you see is very tense and shows large distended veins. There is bile in the stools but none in the urine. The abdomen is uniformly enlarged and a point of interest is that in the veins the current is upward. Before the abdomen became so much enlarged the spleen was palpable.

Of course one was suspicious at first of a local cause of the ascites and the common one at this time of life is tuberculosis. That has been the suspicion in this case until recently. He has had a slight fever so that we could not give him tuberculin. Recently we have rather leaned to the possibilities of an atrophic cirrhosis with ascites; the distension of the veins is very suggestive.

In any case the condition is such now that it would be better to thoroughly drain the peritoneum and that will be done at an early date. He is very uncomfortable and his respirations are embarrassed so that he has reached the stage when tapping has become a necessity. It is by no means easy to make the diagnosis between fluid due to cirrhosis and fluid due to local disease of the peritoneum and this is complicated by the fact that in a certain number of cases of cirrhosis of the liver there is a terminal tuberculosis of the peritoneum and twice it has occurred to me to find both diagnoses true. The abdomen was opened and drained a few days later. The liver was atrophic and cirrhotic.

Exhibition of Cases. Dr. Reik.

Dr. Reik.—I have the opportunity to show you tonight rather an unusual collection of abnormally developed eyes. It is well known, of course, that congenital defects are often associated with heredity and this is frequently noticed in malformations of the eye but one rarely witnesses a more marked instance of hereditary transmission than is seen here. This woman, in every other respect of normal development and perfect health, has a complete coloboma of the iris of the right eye, *directed upwards,* and an incomplete coloboma of the left iris directed *upwards and outwards.* Her right eye is quite amblyopic, vision = 18-200 while the left eye, with + 1.Dc ax. 90°, has vision = 20-30. She has three children, a girl 18 years of age, a son aged 16 and a younger daughter, in whom we are not interested at present because she is only a half sister to the other children and shows no ocular defects. The two older children are present and have defects

which I will explain directly. Let me say first that while coloboma of the iris is not uncommon it very rarely appears in this part of the iris. The usual direction is downward and inward.

The older girl came to me in July, 1901, when examination showed, in both eyes, complete aniridia, posterior polar cataracts, and buphthalmos with a cupping of the disks of about 2 mm. Her vision was only ability to count fingers at three feet, in the right eye, and 2-200 in the left. The most careful inspection with the ophthalmoscope and by oblique illumination failed to reveal the slightest trace of iris in either eye. The patient was almost helpless and there was no hope of improvement in her condition unless it could be secured by surgical means. In addition to the defects mentioned she had a high grade of myopia, estimated by the ophthalmoscope at 12 dioptres, but glasses did not improve her vision. The right eye was selected for operation first and after repeated needlings complete absorption of the lens substance was secured. Discission of the capsule was then performed and the operation was immediately followed by a severe and prolonged attack of glaucoma, the explanation of which is not very clear since there could have been no blocking of the anterior angle in an eye which had neither iris nor lens. The left eye was operated upon somewhat differently after needling the lens to produce a traumatic cataract its extraction was accomplished with the aid of irrigation and a very satisfactory result secured at once and without any complications. With her correcting glasses she now has vision in the right eye of 12-200 and in the left eye of 25-100.

The brother presents at this time much the same condition as I have described existing in the sisters eyes when I first saw her, that is, there is complete absence of the iris, posterior polar cataracts, nystagmus and a divergent strabismus. His lenses are not so cloudy, however, and his vision is sufficiently good to enable him to go along without an operation. I have described these cases in greater detail in the Journal of Eye, Ear and Throat Diseases for January, 1903.

A Review of Ehrlich's Receptor Theory of Immunity. Dr. Marshall.

General Infection with Bacillus Typhosus without Intestinal Lesions. Dr. Harris.

To appear later.

Exhibition of Specimens from a Case of Reynauds Disease. Dr. Van Wart.

To appear later.

April 6, 1903.

The meeting was called to order, in the absence of the President, by Dr. Hurd.

Exhibition of Surgical Cases. Dr. Halsted.

Demonstration of a New Hemo-alkalimeter. Dr. Dare, of Philadelphia.

See Bulletin for July, 1903, page 175.

Solitary Tubercle of the Stomach. Dr. Van Wart.

See Bulletin for September, page 235.

May 18, 1903.

The meeting was called to order by Dr. Hurd.

Exhibition of Medical Cases. Dr. McCrae.

Dr. McCrae.—This patient is a male, aged fifty-six, who comes complaining of pain in the right side and right leg. The family history is negative. He has been a healthy man; is not a heavy alcoholic; no history has been obtained of lues. His present trouble began two years ago with pain in the right side and back; it was sharp and stabbing in character. Ever since then he has had pain more or less constantly. The pain, comes on especially at night; he has to get out of bed and move around to relieve it; of late it has been getting worse. Any ordinary movements increase the pain; he has difficulty in sitting down and getting up. As the man comes up I should like you to watch his gait especially. I think you will all notice that he is favoring his right leg; that is he does not lift it as far from the floor as he does the left and comes down much more gradually on it. In the ordinary examination of the patient there is very little to be made out. He is fairly well nourished. Examination of the extremities is practically negative. The reflexes are, if anything, somewhat diminished. There is no special wasting and as far as the ordinary examination goes the results are negative. When one examines the condition of the spine he finds an explanation for the symptoms. The ordinary examination of the spine shows nothing remarkable. There is a certain amount of bowing forward of the vertebræ, which occurs so commonly with advancing years, and particularly with emphysema, which this man has. In the lower part of the back, where he complains of pain, there is little to be made out. The lumbar curve is normal, and there is only one thing that would attract attention; that is, the muscles of the back are exceedingly rigid; more particularly on the left side. When one tests the mobility of the spinal joints it is at once evident that the mobility is almost negative. He shows that probably in the best way when trying to pick something up from the floor. You see the curious going down on one side. When he stoops forward I think you will notice that there is practically no movement in this part of the spine. The conclusion then is that he has some involvement of the lower spinal vertebræ. The X-ray plate shows very definite deposits of bone between the vertebræ.

The patient does not react to tuberculin and the diagnosis of local arthritis of the spine seems justified. If this man has, as we suppose, local arthritis of the lower portion of the spine, by putting it at rest in a plaster jacket for two or three days his symptoms should be markedly relieved. The diagnosis we make here is of arthritis deformans, and especially of the osteoarthritic type. The lesson we have to learn from such patients is that the back should be very carefully examined. As to the therapy—the great essential in these cases is absolute rest, because apparently the more the joint is disturbed the more irritation and proliferation

of bone there is. It is certain that rest cannot be obtained with the patient in bed. It is very difficult to give them rest in bed and is very much better done with a felt-fitting plaster jacket, which can be left on for two or three weeks and later some light form of apparatus can be substituted, as a leather jacket.

DR. HURD.—Are there any other joints involved?

DR. MCCRAE.—In this patient there are not. In the majority of these cases the other joints are not concerned. We have at present one other patient in the clinic who has quite extensive involvement of the other joints with general spondylitis, viz., the elbows, knees and ankles. Of course, the question as to the involvement of the other joints is an interesting one in reference to two other distinct diseases, the osteoarthritic group and the periarticular, involving the large joints of the extremities. We have had a number of cases showing the co-existence of the two types in one patient, both types belonging to the same disease. This man shows no involvement of any joints outside of the spinal ones.

One other point in reference to diagnosis. These cases are sometimes taken for hip joint disease. On examination of this patient the hip joints are apparently free and there is no limitation of motion. The hip symptoms seem to be referred to the nerve pressure.

The Plague in India. DR. B. ROSALIE SLAUGHTER, of Washington, D. C.

See page 307.

Conservative Perineal Prostatectomy Demonstration of New Instruments and Technique. DR. YOUNG.

To appear later.

Monday, June 1, 1903.

The meeting was called to order by Dr. Hurd, the President being absent.

A Case of Peptic Ulcer, in the Jejunum of a Dog following Gastroenterostomy. DR. WATTS

See BULLETIN for July, 1903, page 191.

A Simple Electric Female Cystoscope. Demonstration. DR. CULLEN.

See BULLETIN for June, 1903, page 166.

Dentigerous Cyst and Adamantine Epithelioma of the Jaw, Lantern Slide Demonstration. DR. BLOODGOOD.

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THE INFLUENCE OF PASTEUR ON MEDICAL SCIENCE.[1]

By C. A. Herter, M. D.

To one who treasures memories of student days spent in your pathological laboratory, when each member of a small and favored group worked under the personal guidance of the great teacher whose unselfish labors have done so much for science in this country, it is indeed an exceptional privilege to address those who represent the School of Medicine that has grown since then to be the model for many an older institution. Yet I am conscious that this very privilege entails a risk,—proportioned to the largeness of the opportunity,—of using unworthily the precious moments which fortune has bestowed on me. My choice of subject has not, I fear, lessened this hazard, for I have chosen to speak to you of one of the most significant men of the past century, whether we consider him as a person, as an investigator, or as a public benefactor. I pray you therefore deal gently with the shortcomings of an undertaking so difficult and ambitious as that of estimating the influence of a great career on the advance of medical science.

Louis Pasteur first saw the light of day on December 27, 1822, in an humble dwelling in the little town of Dôle in the Franche Comté. His parents had small means and limited social opportunities, but through the exercise of forceful character and unusual fidelity to elevated ideals of life, managed to give him a fair elementary education. The father, earnest, industrious and intellectually ambitious, instilled into his son the desire to become a useful and respected member of society, shielded him by constant companionship from the vulgar temptations of youth and fired him with a love of country which a long and honorable career as a soldier of Napoleon had strongly fortified. The mother of young Pasteur was prevented by household cares from sharing closely the intellectual interests of her only son, but showed the depth of her affection by making many a little sacrifice to further his education. She was a spirited woman, possessed of lively imagination and quick intelligence, and it is reasonably clear that the unusual artistic perceptions of Pasteur mark the perpetuation of these maternal gifts. Although the school days of Pasteur appear to have given little indication of an exceptional future, the lad showed some qualities which distinguished his work in later life. In his daily tasks, at which he worked faithfully and deliberately, he showed the most scrupulous accuracy and truthfulness, attributes which are the more noteworthy for the reason that they belonged to a temperament enriched with a strong vein of romanticism, which for a time found expression in a fervid

[1] Address delivered at the opening of the Medical Department of the Johns Hopkins University, Oct. 6, 1903.

devotion to poetic literature. Moreover, Pasteur showed while still in his teens a pronounced capacity for portraiture. During his three years of instruction at the Collège Royal of Besançon, which he entered at eighteen years of age, the young student was more absorbed in literature and art than in science, and impressed his colleagues as being surely destined for an artistic career. The courtesy of Mr. Philip B. Marcou, of Cambridge, has made it possible for me to examine closely two fine examples of Pasteur's work at the end of this Besançon period. Although these portraits disclose the manual hesitancy of the imperfectly trained craftsman, they bear an unmistakable air of distinction and are executed with a respect for detail which is highly remarkable. Anyone who sees these youthful works is likely to feel that eyes so sensitive to these minutest particulars of form, would be apt to see many things which others had failed to notice; and it is noteworthy that Emil Fischer, whose calm judgment is well known, has expressed his belief that Pasteur's crystallographic discoveries were facilitated by his artistic perceptions.

The years at Besançon were followed by a highly important course of study at the Ecole Normale of Paris, during which Pasteur formed the determination to devote himself to science. For the first time in his life, the gifted impressionable young man found himself under the influence of a creative scientific mind of the highest order, a mind which has left a large and permanent mark upon the history of chemistry, and which could not fail powerfully to mold the plastic intelligence of Louis Pasteur. Jean Baptiste Dumas, who had already discovered the great principle of substitution, united to his genius as an investigator the charm of a finished and spirited delivery. His Sorbonne lectures fairly captivated the young student and gave definite and lasting direction to his study and fancy and, later, to his researches. Other teachers of a superior order contributed to lead Pasteur into the promising and fascinating paths of physics and chemistry. The attractive Balard, to whom bromine had first surrendered the secret of its existence, reinforced the chemical teachings of Dumas, and the admirable lectures of Delafosse aroused an enduring interest in the subtle beauty of crystalline forms. But it is to the strong intellect of Dumas that Pasteur owed his first grasp of the great principles of science and that enthusiasm for work, which made it possible to ignore the harsh and depressing material conditions that prevailed at the Ecole Normal. The recognition by young Pasteur of the importance of correlation in the physical sciences is an impressive feature of this mind at this period of close association with great chemical investigators. Evidences of this recognition exist in a singularly fine letter, full of enthusiasm for science, which he wrote to his colleague Jules Marcou,[2] then entering on his distinguished career as a geologist. "Before finishing your letter," says young Pasteur, "I had already regretted that your studies in chemistry were incapable of responding to what geology will often ask of them."——"I know very well that many distinguished geologists have no broad conception of chemistry, but I believe this to be a great pity and I think that geology has not often enough turned to chemistry." The chemist of twenty-three summers held a point of view which was destined very soon to aid him in a memorable research.

It was in the field of crystallography that Pasteur, led by an interest in the ingenious and delicate methods of the science, first showed his exceptional capacity to observe minutely things and processes and to correlate and interpret the results of his observations. He began by carefully repeating a series of crystal measurements on tartaric acid, racemic acid, and their salts, shortly before published by Provostaye. During the study of the recrystallized salts of tartaric acid he observed one very important but unobtrusive thing which the distinguished physicist had overlooked—regular evidences of hemihedral facets. All the tartrates showed a weak kind of isomorphism which is apparently forced on them by the tartaric acid group, whatever other element may exist in the compound. Guided, as he tells us, first, by the observation of Biot, that tartaric acid and its compound rotate the plane of polarization, secondly by a relationship between the crystalline form of quartz and the direction of rotation, and finally by Delafosse's conception that hemihedrism depends on definite crystallographic laws, Pasteur concluded that there is a relation between the hemihedrism of the tartrates and their optical activity. An unexpected discovery soon proved this to be true in a conclusive and beautiful manner. One day in the dark library of the Ecole Normale Pasteur's eyes lighted on a remarkable paragraph from the writings of the Berlin chemist and crystallographer, Mitscherlich, relative to two different saline combinations of tartaric acid, the tartrate and the paratartrate (or racemate) of sodium and ammonium. This note stated that these two types of double salts have the same chemical composition, the same crystal form with equal angles, the same specific gravity, the same double refraction and that in consequence of this their optical axes form the same angles. Their water solutions have the same refraction. The dissolved tartaric acid salt rotates the plane of polarization and the racemic salt is indifferent, as had been found by Biot for the whole series of salts. "But," continues Mitscherlich, "the nature and the number of atoms, their arrangement and their distance from one another are the same in both bodies." The contradiction expressed here upset all Pasteur's physico-chemical ideas and persisted for months in his mind like an interrogation point. But the day came when experience cleared up the mystery by demonstrating that there is really a difference between the tartrates and the racemates which Mitscherlich had not noticed. The former bore hemihedral facets on the right side and always rotated the plane of polarization to the right; the latter bore facets both on the right and on the left sides and did

[2] Mr. Philip B. Marcou has permitted me to read a large number of unpublished letters written by Pasteur to his father. The letter above quoted is dated June 10, 1845, and is one of a very small number belonging to this period.

not rotate polarized light at all. Moreover it later appeared that this inactive racemic acid may be caused to crystallize in such a way that the crystal mass consists of equally numerous dextro-rotary and levo-rotary crystals, the former possessing hemihedral facets on the right side, the latter hemihedral facets on the left side. Both kinds of crystals were isomorphous, but the isomorphrism was that of two asymmetric crystals, of an object to its reflected image. The weighty and surprising discovery had been made that indifferent racemic acid crytsallizes into equal quantities of ordinary dextro-rotary tartaric acid and the newly observed levo-rotary tartaric acid.

This research on the tartrates, culminating in 1848, with the discovery of the nature of paratartaric or racemic acid, proved that Pasteur had already made himself master of the experimental method.

Three distinct practical results followed in the train of this research as a consequence of continued studies of the crystallographic problem. In the first place there came to light numerous fresh evidences of a relation between molecular constitution, crystalline form, and the property of rotating the plane of polarization. It is true that Pasteur seriously entertained some ideas of a highly speculative nature regarding the operation of dissymmetry in nature, ideas which involved him in fruitless experiments; but on the other hand the tangible and positive results of his work must be recognized as forming the basis of the modern doctrine of the asymmetrical carbon atom, which has so illuminated our ideas of the spatial arrangements of the atoms within the molecules of organic substance. Secondly, the research on the tartrates led Pasteur toward the recognition of a series of optically inactive compounds, including inactive malic acid and inactive amyl alcohol. Finally, the crystallographic researches were the bridge over which the far-seeing investigator passed on the way to lay the foundations of a new biological science, a science which has affected a veritable revolution in our conceptions of medical problems. Cagniard-Latour, Schwann and Kützing, by knowledge gained in their experiments on alcoholic fermentation held one pass to the great secret, but saw not the fields of discovery to which it might have led them. Pasteur made his way thither by a singularly trustworthy intuition. Greatly impressed with the circumstance that optically active substances like the sugars, the tartrates, the malates, the citrates, the gums and the proteids seemed to be confined to the organic world and were not to be found outside the tissues of plants and animals, Pasteur made a simple yet decisive experiment. To some pure crystallized inactive ammonium paratartrate he added fermenting albuminous material. After a time the fluid was examined with the polariscope. It rotated strongly to the left. This levo-rotation was obviously due to the fact that the dexto-rotary constituent of the paratartrate had been decomposed. An opically inactive fluid had been converted into an optically active fluid. According to Pasteur's theoretical views this striking change indicated the mediation of living matter. The activity of unorganized purely chemical ferments could not, in his judgment, explain the facts; microörganic life must be in some way concerned. Fortunately the mind in which this conception was born was also capable of testing its correctness by the most rigid methods of investigation. Fortunately, too, the external conditions favored a studious excursion into the processes of fermentation, for Pasteur was called in 1854 to a professorship at Lille in a region of distilleries which involved the training of young men to proficiency in industrial chemistry and made it essential to get new light upon the various kinds of fermentation.

At this period of Pasteur's career the prevalent doctrines of fermentation were singularly unsatisfactory and uncontrolled by searching experimentation. The versatile Spallanzani had nearly a century before taken the important step of showing that putrescible liquids can be permanently protected from the processes of fermentation and decomposition by boiling and exclusion of air. Then Gay-Lussac, inspired by the revolutionary but constructive work of Lavoisier, made his clever attempt to show that the results of Spallanzani were due to the exclusion of the oxygen of the air from the decomposable materials, and the ingenious French cook Appert puts this erroneous idea to important practical use in his widely employed method of canning perishable foods. Thus in the early days of the nineteenth century people were content to think of alcoholic fermentation as purely a chemical process. The first great blow to this widely accepted doctrine came from Theodor Schwann's incisive studies of the yeast plant in its relation to alcoholic fermentation. Very clearly did Schwann show that oxygen does not suffice to initiate the fermentation of sugar and that the necessary condition is the presence of something which is destroyed by heat—a living organism. Unfortunately he failed to maintain aggressively the new doctrine of the dependence of fermentation on microörganic life. The result was that the new vitalistic hypothesis failed to make any important advance in the face of the sharp criticism and ridicule of so active and influential a teacher as Justus Liebig, whose word was nearly everywhere received as final in matters chemical and physiological.

To Liebig and to many others it seemed a retrograde step to assume that a living organism like the yeast plant is the cause of alcoholic fermentation, for the most advanced scientific thinkers were eagerly striving to explain the phenomena of life by physical and chemical laws and the rôle of "vital force" was being successfully restricted almost from day to day. Liebig pointed effectively to the fact that sugar undergoes other kinds of fermentation than alcoholic, such as lactic and butyric, but that nothing like a yeast organism was to be seen in these allied types of decomposition. It seemed to him that these various kinds of decomposition had one feature in common, the presence of a small quantity of nitrogenous substance. This dead material operated as the real ferment, by communicating a kind of shock to the molecules of sugar or beef extract with which it came in contact, which resulted in the fragmentation of the molecule into

smaller molecules, the essence of fermentation and putrefaction.

To Pasteur the position of Liebig was wholly unintelligible because it rested on prejudice much more than on experimental evidence. He resolved to investigate the subject of fermentations from the standpoint which he had reached by observing the fermentation of the paratartrates—that is to say with the preconceived idea that fermentation depends on the mediation of living organisms. The first notable paper in the long series which solved one of the most pressing questions in biology deals with lactic acid fermentation.[3] It might perhaps have been anticipated that Pasteur's first important utterance on the nature of fermentation would deal with the alcoholic form which has so great a commercial importance. He discovered, however, in lactic fermentation an admirable field on which to contest the ideas of Liebig and his followers, who were constantly pointing out that in lactic fermentation, so like the alcoholic form, there is nothing at all like a yeast ferment. This research ended, as is well known, in the discovery of a specific lactic acid organism or ferment, and in the cultivation of this and other organisms in an artificial medium free from albuminoids. Pasteur was not slow in forming the hypothesis that different types of fermentation are dependent on different types of microorganisms and this idea of specificity soon established in relation to the ordinary decompositions ultimately became the basis of our modern knowledge of the infectious diseases.

The research on lactic acid fermentation thus gave the *coup de grâce* to the chemical theory of fermentation at the same time that it marked the birth of the promising science of bacteriology. The development of a method designed to secure pure cultures from fluid media, the use of culture media of known composition and the careful chemical study of products of decomposition all belong to this early period of Pasteur's life and were achievements of the deepest significance for the future of the great department of knowledge which has revivified the biological sciences.

Another research on fermentation deserves more than passing notice on account of the extraordinary discovery which appears as its almost accidental by-product. This is the investigation on butyric acid ferments (1861). This research brought to light the fact that there are motile organisms capable of inducing a decomposition of sugar with the production of butyric acid. In the course of this research Pasteur saw that these organisms (whose motility was most puzzling on account of its suggesting animal life), behaved very differently according to their position with reference to the cover-glass, those at the center being active, while those at the periphery and exposed to the air were checked in their movements.* From this casual observation came the fundamental conception of anaerobic life. All physiologists recognize to-day "A class of beings possessing such vigorous respiratory power" as Pasteur aptly says, "that they are able to live without the influence of the air by taking oxygen from certain compounds, thus occasioning in the latter a slow and progressive decomposition."

That Pasteur's original and searching examination of the problem of fermentation would one day lead him into a controversy over the unsettled question of spontaneous generation might almost have been predicted. The long discussion with Pouchet and Bastian, containing something of bitterness and not a little of the ridiculous, is a dramatic and animated chapter in the life of a peaceable but truth-loving man. As students of the influence of Pasteur on medical science we need not pause to review this controversy, for its fruits are to be found in all his subsequent work on the specific nature of the infectious diseases. Yet this discussion, prolonged over nearly twenty years, and replete with instruction and entertainment, is worthy of a permanent place in the memories of scientific men.

After a public victory over Pouchet in 1862, which brought in its train the honor of election to the Academy of Sciences, Pasteur turned his attention toward two subjects of much practical interest which seemed closely connected with the phenomena of fermentation. One of these was the manufacture of vinegar, the other the diseases of wine. The study of vinegar led to the recognition of the micro-örganic nature of the vinegar film or mycoderma and brought acetic fermentation into line with lactic and butyric fermentations. It led also to the discovery that the oxidation of alcohol through the agency of the vinegar organisms may be carried too far, acetic acid being lost by oxidation to water and carbon dioxide. Then again Pasteur was able to aid the makers of vinegar by teaching them that the indispensable film formation can be facilitated by the actual transfer of the living ferments to the surface of the vinegar. In the study of the diseases of wine, Pasteur achieved even more helpful practical results, for after recognizing the dependence of sour bitter and muddy wines on the presence of definite types of living ferments, he was able to suggest a simple and efficient way of controlling these disturbing agencies by the use of moderate heat. From this recommendation has sprung the use of

[3] During the years 1858 and 1859 Pasteur did highly important work on alcoholic fermentation. His views as to the significance of molecular dissymmetry had already led him to regard the levo-rotary action of amyl alcohol as an indication that this regular product of alcoholic fermentation is found by the mediation of living organisms. It was in fact his study of amyl alcohol (1855) together with the experiment on inactive ammonium paratartrate that incited Pasteur to undertake researches on the method of fermentative processes. His superior chemical training under Dumas was used to great advantage in all the researches on fermentation. In the case of alcoholic fermentation Pasteur showed that the acid formed is neither acetic or lactic acid but that succenic acid and glycerine are regular and not unimportant products. Lavoisier and Gay-Lussac represented the sugar in alcoholic fermentations as splitting wholly into alcohol and carbon dioxide, but the work of Pasteur showed that five or six per cent of all the sugar is not decomposed in this way.

[4] Pasteur fell into the error of describing the butyric acid organisms as infusorians and thought he had shown that animal life can exist without oxygen.

the widely employed method of sterilizing which we call Pasteurization.

In Pasteur's growing interest in these works of practical utility we can detect a tendency which was destined to bear rich fruitage in medical science,—the inclination to employ the gifts of which he could no longer fail to be conscious, in a manner likely to be directly helpful in relieving the needs of his fellow men. It was this attitude which made it possible in 1865 to lead Pasteur not without regret away from his studies of fermentation, to a wholly new sphere of endeavor. In that year the mortality among the silkworms of northern France was so great that the silkworm industry was threatened with total extinction and grievous famine was making its appearance in a land where comfort and contentment had long reigned. Dumas, acting for a Senate Committee, selected Pasteur to solve the mystery of the plague. To Pasteur's remonstrance that he knew nothing of the subject and had never seen a silkworm, Dumas answered, "So much the better, you will not have any ideas except those that come to you through your own observations." There were many unfriendly comments on this appointment, for some scientific men could not understand why a chemist should be chosen to cope with an obscure zoölogical problem. But Dumas knew his man and confidently relied on the great gifts he saw in him. It was quickly evident that his faith was not misplaced. Only twenty days after his arrival at Alais, Pasteur prepared a note in which he outlined a method of breeding from the eggs of silkworms free from disease. Unlike his predecessors he made the moth the center of the efforts to regenerate the race of silkworms. "If the butterfly is sick, reject all its eggs." It required five years of Pasteur's most devoted attention, five years beset with uncertainties and disappointments, to establish this almost clairvoyant conception on an incontestable scientific basis. At the end of this period Pasteur and his highly skilled assistants had shown that there were two distinct diseases from which the silkworms died, pébrine or corpuscle disease, and flâcherie, a bacterial affection of intestinal origin. The former was proved to be a specific disease due to the psorosperm *Nosema bombycis;* the latter was believed by Pasteur to depend on a specific bacterium, but can probably be excited by several distinct varities of bacteria. The pébrine disease, which was the chief scourge of the industry, was eradicated through the use of a careful system of breeding from eggs shown by microscopical examination, to be free from infection. The immense practical importance of this method sociologically as well as financially can be better left to the fancy than expressed in dollars and cents. But these immediate practical results do not adequately express the far-reaching effects of the great silkworm research which marks the entry of Pasteur into the realm of animal pathology, and is thus the vestibule of modern medicine. For it is true that the laws governing the propagation and development of the flâcherie disease have the most striking analogies to those of the diseases of man. The varying susceptibilities of different individuals to the same microörganisms, the influence of the path of infection and the fact that flâcherie organisms acquire increased virulence after passage through the bodies of living silkworms foreshadow discoveries in human pathology. The two volumes dealing with the diseases of silkworms and dated 1870, are works whose contents should be familiar to every independent student of the infectious diseases.

The researches on the silkworm diseases had one practical effect of considerable importance for Pasteur's later career. The success with which Pasteur had solved his intricate and widely known problem made it natural that French investigators of animal pathology should in future turn to him as the man most likely to help them in their work, and this brought to him new opportunities for fresh successes.

It is likely that excessive work and mental stress in some degree contributed to the onset of the series of paralytic seizures which in October, 1868, threatened the life of Louis Pasteur. During the critical period of his illness many of the most distinguished scientific men of France vied with each other to share with Mme. Pasteur the privilege of nursing the man they loved so well, and of rescuing the life that had already placed science and a nation under enduring obligation, through discoveries which were either of the greatest practical utility or appeared susceptible of almost unlimited development. Had Pasteur died in 1868, he would have left a name immortal in the annals of science. Others would in some degree have developed his ideas. Already inspired by the researches on fermentation Lister would have continued to develop those life-saving surgical methods which will forever be associated with his name. But we may well question whether investigations in biology and medicine would not have been, for a time at least, conducted along less fruitful paths. Who shall say how soon the great principle of experimental immunity to pathogenic bacteria, the central jewel in the diadem of Pasteur's achievements, would have been brought to light.

When Pasteur recovered sufficiently to resume work it was soon clear to apprehensive friends that he had no intention of leaving his ideas to be worked out by other men. The miseries of the Franco-Prussian war deeply affected him, and could not fail to inhibit his productiveness, but after a time the unquenchable love for experimental research was once more ascendant, and there began a new epoch, the epoch of great discoveries relating to the origin and cure or prevention of the infectious diseases of man and the domestic animals. As in the case of Ignatius Loyola, it seems as if the lamp of genius shone with a larger and more luminous flame after the onset of bodily infirmity, in defiance of the physical mechanism which is too often permitted to master the will.

The hostility of Pasteur to Germany and all things Teutonic was greatly intensified by the events of the Franco-Prussian war and has left a somewhat regrettable impression on his scientific work. Desiring to contribute to the rehabilitation of his unhappy country he was led to improve the processes of brewing, with a view to increasing the wealth of France and at the same time lessening the yearly tribute

to the despised people beyond the Rhine. It was easily shown that some of the diseases of beer are due to the action of bacteria allowed to take part in the process of fermentation. But it soon became clear that the mere exclusion of these microörganisms does not insure a brew of good beer.

The problem was considerably complicated by the difficulty of deciding what constitutes excellence in beer, and this situation was not helped by the fact that Pasteur, who disliked the German drink almost as much as he disliked Germans, could not distinguish one brew from another. Nevertheless after many discouragements he succeeded in establishing methods, which much improved the character of French beers, methods involving the aeration of beer-wort by sterilized air and the abandonment of open coolers. The results were far from satisfactory owing to the circumstance that Patseur quite overlooked the part played by the undesirable forms of yeast—so-called wild yeasts—in the production of abnormal fermentations. In fact it is doubtful if he could have separated the different types of yeast by the methods at his command, for even in so late a work as the famous "Etudes sur la Bière," bearing the date 1876, we are struck with the inadequate character of Pasteur's devices for obtaining pure cultures of micro-organisms.

This work, with its tender dedication to the memory of Pasteur's father, was a highly important contribution to bacteriology in spite of its many botanical defects. It is really a bacteriological potpourri bringing together the writer's views on many questions, rather than a strict treatise on the diseases of beer. Besides chapters on the causes of bad beer and improved methods of brewing, the volume treats of the origin of ferments and furnishes conclusive experimental evidence against that plastic doctrine of the transformation of species around which the friends of the spontaneous generation fallacy were hopefully rallying. But by far the most striking and original chapter in this notable volume is that in which Pasteur formulated his physiological theory of fermentation—the startling theory that the essential characteristic of fermentation is life without air, life without free oxygen. This theory, if not entirely upheld by other biologists, has at least proved a powerful stimulus to new studies of this unexplored aspect of life.

Pasteur's life was prolonged a quarter of a century after the close of the war with Germany and during a large part of this long period his mind dwelt almost unceasingly on two phases of the great biological and practical problems which it was his fortune to develop so fruitfully. One of these was the investigation of the etiology of disease as related to the activity of microörganisms. The other was the experimental study of the amazing phenomena of immunity to the action of specific viruses or virulent microörganisms. These two affiliated phases of bacteriological research culminated in one of the most remarkable discoveries of all time, remarkable for its practical results but even more striking as an example of the use of the imagination in science. It is well worth while to consider the chief events that ultimately led to the discovery of a method of immunization against the virus of hydrophobia.

The idea that some diseases are due to living microörganisms was suggested by Boyle two hundred years before the days of bacteriology. From time to time thoughtful men took up this idea as worthy of discussion but it received no substantial confirmation until Schoenlein, with the aid of the microscope made his admirable discovery of the infectious nature of ringworm. This was in 1839. Within a few years Henle, the gifted anatomist of Göttingen, proposed an ingenious explanation of the infectious diseases which assumed the agency of microörganisms, but the theory though based on thoughtful clinical considerations was deficient in experimental data and had little practical influence on medicine. It is scarcely surprising that the leading scientific minds of the epoch should have been hostile to any mere hypothesis of contagion by germs, for in their struggle against the ancient conception of a vital force they regarded the idea of a *contagium vivum* exactly as Liebig had regarded Schwann's and Pasteur's doctrine of fermentation. Even the illuminating cell-doctrine of Virchow was not especially favorable to the idea that living organisms from outside can excite disease by fixing themselves and developing in the body. Pasteur's training and temperament and genius admirably fitted him not merely to detect the great central truth of etiology but to force it, in spite of stubborn opposition, upon a doubting world half stunned at the boldness of the new doctrine. But while he took a large part in compelling this revolution in the conception of disease the way was prepared by others, and especially by the fine observations of the biologist Casimir Joseph Davaine and the accurate and ingenious experimental methods of Robert Koch.

Davaine while assisting the clinician Rayer in the study of the devastating anthrax plague in 1850 observed little thread-like bodies in the blood of animals dead of this disease. Ten years later Delafond observed these little threads to be living organisms with the power of multiplying outside the body. Thirteen years after his first observations Davaine, incited by Pasteur's suggestive work on the butyric acid ferment, reopened his study of anthrax and confidently proclaimed that the organisms he had found were the cause and the only cause of anthrax. But it required the superior technique of Koch unquestionably to obtain the anthrax organisms in pure culture to follow the cycle of their development in the animal body and thus to place the important discovery of Davaine on an impregnable scientific foundation. Pasteur, entering this field a little later, independently worked out some of the most striking features of the etiology of anthrax and convinced the best scientific minds of France of the relationship between the bacilli of Davaine and the perpetuation of the anthrax plague.

Very closely associated with Pasteur's work on anthrax is the admirable research in which the master, aided by Joubert and Chamberland, discovered the organism known to us as the bacillus of malignant œdema but described by its detectors as the *vibrio septique* in the same year (1877), in which

the well known publication on anthrax appeared. Of the many excellent features for which this research is distinguished there are two that deserve especial mention. First, the recognition of the septic vibrio in the blood of animals not newly dead of anthrax was an extremely important service in clearing up the gravest objections to Davaine's doctrine of the etiology of anthrax. Secondly, the observation that the septic vibrio is anaerobic affords the earliest example of a pathogenic organism which in its vegetative form is inhibited by the presence of oxygen—a discovery which we may reasonably attribute to the experience gained sixteen years before with the butyric ferment.

In looking for fresh proofs of the bacterial origin of disease Pasteur made some visits to the hospitals of Paris and thus came into closer relations with the practitioners of medicine and surgery. The alert and intellectually honest minds bade him welcome and gave him every help to pursue his studies; the conservatives looked at him askance, confidently set up their time-worn theories against his experimental proofs and lost no occasion to ridicule the germ theory of the origin of disease. To-day it is difficult for us to picture the incredulity and amazement of many prosperous and self-satisfied practitioners on hearing Pasteur's announcement that he had found the same pus exciting microörganisms (probably the staphylococcus pyogenes aureus) in the pus from a series of boils and in the pus from osteomyelitis, and that these conditions, so different in clinical characters, are identical as regards etiology. Very soon a second bomb of the same nature fell into the conservative camp with the confident and even fervid declaration that childbed fever is a septicaemia commonly due to a coccus in chains (streptococcus)[5] which could be detected in the cavity of the uterus, in the blood of the uterine sinuses, and in the blood of living patients. The far-reaching practical results of this investigation, to which Pasteur devoted only one short publication, are so well known to you that they call for no comment here.

Not long after the beginning of the anthrax study the attention of Pasteur was directed to a disease which was destined to play a remarkable part in leading to the great goal toward which the researches of the master were carrying him —the discovery that it is possible experimentally to induce immunity to disease caused by virulent microörganisms. Perroncito of Turin and Toussaint of Toulouse had reached the conclusion that an organism detected by the former is the cause of chicken cholera, but neither had the requisite bacteriological training actually to establish the correctness of this contention. Pasteur was consulted on the subject, and bringing to bear his superior knowledge and technical skill, succeeded in growing the organism outside the animal body and in experimentally inducing chicken cholera by means of these cultures grown *in vitro*. Returning to the laboratory after a short absence he found that his cultures of the bacilli of chicken cholera had failed to grow or had grown only feebly. To increase the activity of these microorganisms they were now inoculated into normal fowls—a procedure suggested by previous experiments with other bacteria. The results were disappointing, for the inoculated animals showed no signs of the disease. This made it necessary to isolate and grow actively pathogenic bacteria from animals with chicken cholera. Having done this it occurred to Pasteur that it would be of interest to inoculate with fresh and virulent bacilli the animals already treated with the attenuated strain of chicken cholera organisms. This was done without delay, and to his surprise nearly all of these prepared animals resisted the virulent germs. They had been immunized by means of the attenuated cultures and a new principle had come into medicine. By experimental study and long reflection on the work of Jenner, the mind of Pasteur had been prepared to grasp the immense practical significance of this discovery. It appeared probable that what had been accomplished for chicken cholera could be extended to other diseases. One special consideration made Pasteur feel hopeful as to the possibility of immunizing sheep and cattle against anthrax. He had noticed that certain sheep long exposed to anthrax through grazing on infected pastures did not die after experimental inoculation with a virulent anthrax culture whereas previously unexposed animals of the same herd died promptly after such inoculation. Moreover, he knew from experience that fowls can be immunized against chicken cholera by feeding them the specific germs of that disease and this fact strongly suggested a similar explanation for the anthrax immunity which he had noticed. With this analogy in mind Pasteur took the first step toward the preparation of a vaccine against anthrax. As in the case of chicken cholera he strove to attentuate the specific organisms of the disease. This he tried to do in the way that had succeeded so well in the case of chicken cholera, that is by exposing anthrax cultures to an abundance of oxygen at the body temperatures. But Pasteur found that under these conditions the anthrax organisms retain their virulence, owing, he believed, to their capacity to produce resistant spores. To check this growth of the anthrax spores he successfully resorted to the procedure of growing his cultures at a temperature of 42°—43° C. in the presence of oxygen. By varying the procedure somewhat he was able to prepare a series of anthrax vaccines of different degrees of activity, the use of a mild vaccine being followed by that of a stronger one in the course of immunization.

The announcement by Pasteur, Chamberland and Roux of a method of protecting animals against the anthrax scourge excited great public interest but was in many quarters received with skepticism and derision. Pasteur was invited to make a large scale public test of his claims near Melun at the farm of Pouilly le-Fort. He accepted the challenge gladly and on May 5, 1881, began a series of public inoculations which will always be memorable in the annals of medical science. The publicity with which the unique experi-

[5] Pasteur's description of the organism found in puerperal septicaemia is not full enough to make it certain that he was dealing with pure cultures of the streptococcus pyogenes.

ment was performed; the unconcealed hostility and suspicion of many of the on-lookers, and the alternating hopes and fears of Pasteur, have been most entertainingly described by M. Vallery-Radot. The outcome was a convincing demonstration of the practicability of Pasteur's method of immunizing against anthrax in sheep. Nevertheless, two years later, in an ill-natural attack on Pasteur's work, Koch attributed the discovery of vaccination against anthrax to Toussaint and pointed to a paper in which the later had reported some experiments describing the immunization of dogs and sheep by means of anthrax bacilli which had been heated at 55° C. for 10 minutes.

While it is true that Toussaint thus immunized animals against virulent anthrax organisms, his method of obtaining a vaccine was unreliable and unsuited for practical use. The fact is that Toussaint, stimulated by Pasteur's discovery of a method for immunizing against chicken cholera, prepared a vaccine which sometimes protected against the disease but which was dangerous owing to uncertainty as to the number and condition of living anthrax organisms which it contained. His publication appeared six months after that of Pasteur who although greatly interested in the observation of Toussaint, criticised the methods of the latter and ultimately prepared a safe vaccine consisting of definitely attenuated anthrax organisms. The crude experiments of Toussaint were wholly based on the epoch-making immunization to chicken cholera.

On March 15, 1882, Louis Thuillier, the earnest and gifted but ill-fated young assistant of Pasteur, discovered in the blood of swine dead of erysipelas (rouget de porc) an organism which appeared to be the active agent of this plague—an organism which Klein in his elaborate investigation had quite overlooked, but which was independently discovered by Detmers of Chicago. Pasteur had inspired this fine research of Thullier and stood ready to develop it. By carrying the suspected organism through many generations on veal bouillon and finally introducing it into hogs, the true swine erysipelas was readily induced. The real problem, however, was to make an attenuated virus for the purpose of immunizing against the disease. Pasteur succeeded in obtaining a virus capable of protecting certain races of hogs for a period of a year or more and this important practical success is rendered especially noteworthy by the method that was followed in attenuating the rouget organisms. In 1887, he had found in the saliva of rabid dogs an organism highly virulent for rabbits (micrococcus of rabbit septicæmia).[6] Adult guinea pigs were immune but young guinea pigs quickly died after inoculation. By passing the organism through a series of young guinea pigs it gained in virulence until it grew fatal for adult guinea pigs. But the modification which especially impressed Pasteur was that the bacteria which had thus gained in pathogenic qualities for guinea pigs had at the same time become attenuated for rabbits.

The memory of this singular observation now came to his aid in the rouget research. After passing the rouget bacteria through a series of pigeons (which are naturally susceptible) it was found that the blood from the last pigeon had become much more pathogenic for swine than blood from hogs dead of swine erysipelas. On the other hand, Pasteur discovered that while the passage of the rouget organisms through a series of rabbits (which are not naturally susceptible) permitted these bacteria to grow more readily in the blood of the rabbits and to become more highly pathogenic for them, they became definitely and permanently diminished in virulence for swine. Thus after inoculation with modified organisms, hogs became ill but did not die. On their recovery they were immune to fatal rouget. The genius of Pasteur thus gave to biological science a definite method of permanently modifying the pathogenic characters of certain microorganisms. This contribution is recorded in a paper which won the applause of the Academy of Medicine and which even to-day excites admiration for its mingling of experimental skill and scientific imagination.

So far back as 1880, in the midst of the exacting anthrax investigation, Pasteur had found time to begin a new research on the protective action of attenuated virus. From modest beginnings this research grew in the hands of the master to be the crowning work of his life, in the sense of embodying the fullest and in some respects most original expression of his ideas on the use of experimentally enfeebled viruses for the mitigation of infectious processes. The transmission of rabies through bites made probable the infectious nature of the disease and encouraged a hope that it would not be very difficult to isolate the specific organism from the saliva of rabid dogs. But the most systematic efforts to isolate such an agent were rewarded only by failure. To this disappointment was added a second, even more disconcerting. It was found that the experimental transmission of the disease by means of saliva is a matter of great uncertainty. Moreover the uniformly fatal outcome of hydrophobia made it impossible to form any opinion as to whether the unknown virus was capable of conferring immunity. Many an investigator would have been deterred from the prosecution of an enterprise so unpromising, but the interest of Pasteur had been fully enlisted before he realized the difficulties of the problem, and the tenacity of his nature urged him to keep patiently on his course. He saw clearly that a reliable way must be found to communicate rabies experimentally and acting on a suggestion made by Dr. Dubue of Pau, that the disease is essentially one of the central nervous system, Pasteur took small bits of nervous tissue from animals dead of rabies and placed them under the skin of experimental animals. This method was no considerable improvement on similar inoculations of saliva from rabid dogs, but it served as the clew to a notable advance. This was the introduction of rabic nerve-tissue directly into the central nervous system of the animal to be infected, a procedure based on the idea that since rabies behaves like a disease of the nervous system the microorganisms causing it would be likely to find in the nervous system a living culture

[6] Micrococcus lanceolatus.

medium highly favorable to their growth. The acute intelligence of the masterful experimentalist is strikingly illustrated by the fact that failure to isolate specific microörganisms had not shaken his faith in the testworthiness of his preconceived idea. Hence when he found that hydrophobia regularly followed subdural inoculation with rabic nervous material he was more pleased than surprised. The first dog thus inoculated showed unmistakable signs of rabies after fourteen days and other animals gave similar results. Moreover on bringing into practice the experience he had gained in studying swine erysipelas, Pasteur found that he could increase the pathogenic properties of the virus by carrying it subdurally through a series of rabbits or reduce it for dogs by carrying it subdurally through a series of monkeys. He thus had at his command three different viruses, a virus of natural strength, a virus of increased virulence and an attenuated virus. Later experiments showed that a safer virus could be prepared by drying over caustic potash at 21° C. the spinal cords of rabbits dead of rabies.

By injecting subcutaneously first a weak virus and subsequently a stronger one into parts with very few nervous structures Pasteur succeeded in immunizing dogs against otherwise fatal subdural inoculations. This success suggested the possibility of immunizing human beings. The relatively long duration of the period of incubation, which is commonly about forty days, made the outlook for human immunization peculiarly promising. The opportunity for trying the method soon appeared in the person of the little Alsatian lad, Joseph Meister, who came to Paris with fourteen wounds inflicted by a rabid dog. Pasteur courageously resolved to make an effort to rescue the bitten child from the certain death to which he was doomed, by making successive injections of rabbit viruses of increasing strength. The result is known to all the world; the effort to utilize the long period of incubation to quickly establish immunity through repeated inoculations, proved a success, not only in the case of little Meister, but in many thousand other instances.

The great research on rabies fittingly marks the culmination of Pasteur's long career as an investigator. In that investigation can be seen the same technical skill, the same respect for minute detail and the same pertinacity that had distinguished so many earlier researches, but there can be seen also a degree of originality and a fertility of resource that excel nearly all previous exhibitions of these powers. The accumulated experience of a quarter century of original study of microörganic life served as liquid intellectual capital on which Pasteur drew for guidance at every turn in the extraordinarily intricate and perplexing study of rabies. And it seems wholly clear that this new discovery could never have been made without such a treasure of experimental experience.

One who looks only at the results of Pasteur's far-reaching work is apt to overlook his mistakes and shortcomings and to forget that he made some serious errors not only in the interpretation of experimental data but sometimes also in experimental technique. To pathologists of the present day Pasteur's conception of acquired immunity appears so crude that it is difficult to believe he ever entertained it seriously. His work on chicken cholera naturally led him to form a theory to account for the immunization which he observed and this theory was that immunity arises from the inability of a pathogenic organism to grow in a medium in which it has previously developed. Animals thus become immune because the necessary nutrient material for the multiplication of the specific organisms has been made up, just as an organism will after a time cease to grow *in vitro* in an old culture medium. It seems strange that he did not test this theory by trying to grow the organisms outside the body in the blood and serum of both the immunized and normal animals and so learn that he was in error. The short and usually inadequate descriptions of microörganisms which Pasteur has given in his terse publications have aroused much criticism from bacteriologists and it cannot be denied that he underrated the importance of minute morphological and cultural studies, studies without which some of the most important modern advances could not have been made. Nor is it easy to explain the reluctance with which he adopted the improved bacteriological technique of other investigators. Koch's method of plating bacteria, Weigert's and Ehrlich's methods of staining, and certain important nutrient media found their way into his laboratory only after long delay and through the efforts of assistants. Pasteur's comparatively faulty technique for obtaining pure cultures of bacteria is doubtless responsible for many of the disheartening results that have been reported by foreign observers who used his vaccines, which appear to have been to often contaminated. Nevertheless his methods in the main served their purpose well, and we should remember that the most finished instruments cannot belong to the pioneer who makes his own tools. Fortunately, Pasteur was greatly favored by the circumstance that in many of his etiological studies he made cultures from the blood, where the specific microörganisms often existed in pure culture.

Although even the plainest narrative of Pasteur's individual achievements is proof enough that his work holds a unique position in the history of biological science it is worth while to consider in more general terms what it was that the consummate experimentalist added to the science of medicine. Such a consideration gives us a more just measure of his influence than the most detailed recital of specific investigations. If we would understand the influence of Pasteur on medical science we must recognize that his example as the apostle of an almost untried method of approaching the problems of medicine has been no less enlightening than his actual discoveries. Emerson has said "Great men exist that there may be greater men." The recent history of medicine in the United States as well as in Europe, plainly shows that the seed of example sown by Pasteur has already fallen on receptive soil from which have sprung new combinations of human faculties powerful for the amelioration of human life. Our country has no greater cause for satisfac-

tion than the knowledge that the ideality as well as the methods of Pasteur have inspired a growing circle of original investigators in medical science who labor for the common welfare. Let us hope that this circle will be continually widened, in the future as in the past, by accessions from the students of this university, where the best ideals of work have been so richly nurtured.

Perhaps the most deeply significant feature of Pasteur's contributions to medicine is their direct dependence on the principles of physics and chemistry, the sciences that so often lie at the heart of real advances in biology. Medical men trained along the conventional semi-scholastic lines had often dabbled with these fundamental sciences and sometimes the superficial contact had yielded creditable or even important results. In many instances also truly great advances had come from the labors of men who like Malpighi, Bichat and Johannes Müller were wide awake to the fact that sound medicine must rest on sound biological conceptions.

But despite the activity of numerous gifted medical men of broad scientific sympathies, the medical profession at the beginning of Pasteur's career was dully following a well-trodden but nearly blind road, in the hopeless struggle to solve the intricate problems of human pathology and physiology by minute observations and experiments confined largely to the most complex representatives of animal life. Then for the first time there appeared in the biological sciences a man profoundly trained in the methods of chemistry and physics and inspired, moreover, with a firm confidence in the applicability of these sciences to the solution of biological and medical problems. Triply armed with a sound method, a lofty imagination and a strong will to serve his country, Louis Pasteur entered the wide arena of medical research, to win there the triumphs that have reconstituted medicine and have secured him an undying fame. Step by step, with rigid logic and unfaltering determination, he passed from the early crystallographic discoveries to the new conception of fermentation and from this to the crucial discoveries relative to etiology and immunity for which the medical sciences had waited so long.

To have fought the long battle of life with unwavering constancy to the loftiest ideals of conduct, toiling incessantly without a thought of selfish gain; to have remained unspoiled by success and unembittered by opposition and adversity; to have won from nature some of her most precious and covert secrets, turning them to use for the mitigation of human suffering:—these are proofs of rare qualities of heart and mind. Such full success in life did Louis Pasteur attain, and from the consciousness of good achieved, his noble nature found full reward for all his labor.

Of the children whom fortune has endowed with splendid gifts, there are few whose lives have affected so profoundly and so beneficently the fate of their fellows, few who have earned in equal degree the gratitude and reverence of all civilized men. Although not many can hope to enrich science with new principles, all of us may gain from Pasteur's life the inspiration to cultivate the best that is in us. Let us keep living in our memories the inspiriting words which the master spoke on the 70th anniversary of his birthday:—"Young men, young men, devote yourselves to those sure and powerful methods of which we as yet know only the first secrets. And I say to all of you, whatever may be your careers, never permit yourselves to be overcome by degrading and unfruitful scepticism; neither permit the hours of sadness which come upon a nation to discourage you. Live in the serene peace of your laboratories and your libraries. First ask yourselves, what have I done for my education? Then as you advance in life, what have I done for my country? So that some day that supreme happiness may come to you, the consciousness of having contributed in some manner to the progress and welfare of humanity. But, whether our efforts in life meet with success or failure, let us be able to say when we near the great goal, 'I have done what I could."

ASCENDING RENAL INFECTION: WITH SPECIAL REFERENCE TO THE REFLUX OF URINE FROM THE BLADDER INTO THE URETERS AS AN ETIOLOGICAL FACTOR IN ITS CAUSATION AND MAINTENANCE.*

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A year ago I[1] advocated and described a more radical operation for carcinoma cervicis uteri, which consists in the removal of the lymphatics from the sides of the pelvis and *en masse* with them the uterus and growth, and all the tissue from pelvic wall to pelvic wall. This is the reverse of an operation where a hysterectomy is done and the glands are then "dug out" from among the pelvic vessels. It is also a more extensive operation, in that the tissues between the growth and the glands, and the glands themselves are removed together with the uterus and the growth. The indications for such an operation are the high percentage of recurrences, namely, about 88 per cent of the cases in this hospital in which five years or more have elapsed since the operation; the involvement of the lymphatic glands in from 30 to 50 per cent of

* Read before the Johns Hopkins Medical Society, October 12, 1903.

the cases as reported by Wertheim and others; and in addition the fact that the presence of cancerous tissue in the parametrium cannot be clinically diagnosed, as I have emphasized in the article referred to. Such an operation is indicated most in so-called favorable cases, for in these there is the best chance for a cure. The question arises, What should be done with the lower end of the ureters? If they are dissected free from this tissue, ureteral necrosis may occur; at any rate the tissue has not been removed undisturbed. On the other hand, if the lower 4 cm. of the ureters are removed with the growth and the renal ends of the ureters are implanted in the bladder, there is the danger of an ascending renal infection, for cystitis is an only too frequent sequel of such an operation. I have done 10 of these more radical operations, resecting one or both ureters in 3 cases. Three of the 10 cases have died, one on the fifth day from intestinal obstruction and two from ascending renal infection, one dying on the ninth day and the other on the seventeenth day. In these two cases the ureters were resected in one and not in the other. These cases demand a better knowledge of the anatomy and physiology of the ureters and bladder and the etiological factors in the causation of cystitis and ascending renal infection. The necrosis of the ureters, uretero-vesical implantations and etiological factors in the causation of cystitis will be treated of in subsequent articles.

The association between cystitis and renal infection is a very interesting one, and frequently it is impossible to ascertain which is the primary seat of the trouble. One realizes that the presence of an inflammatory process in one organ does not necessarily indicate a similar condition in the other. A person may have a stone in one kidney with a suppurative pyelitis and yet there may not be any symptoms referable to a cystitis and on cystoscopic examination the bladder, into which the diseased kidney is discharging purulent urine, may appear normal. Likewise, every case of cystitis does not cause a renal infection.

There are three avenues by which organisms may gain access to the kidneys from the bladder:

I. The blood-vessels.
II. The lymphatics.
III. The ureters.

I. THE BLOOD-VESSELS.

Organisms entering the veins of the bladder might reach the kidneys through the following blood-vessels:

A. General circulation.
B. Vesico-utero-ovario-renal anastomosis.
C. The blood-vessels of the ureter.

A. GENERAL CIRCULATION.

The frequency of the appearance of the bacillus typhosus in the blood and urine of typhoid patients serves as an important aid in the diagnosis of this disease. Lennander[2] advocates that urine cultures should be taken in cases of peritonitis as a possible means of diagnosing the organism causing the peritoneal infection, and at the same time he calls attention to the fact that it is uncertain, because certain organisms, as, for example, the pneumococcus, cannot live in acid urine. It would seem, in many infective processes, that at some time the organisms may escape into the circulating blood and may frequently be eliminated from it by the kidneys without appreciable injury to the latter. For, aside from the presence of organisms in the urine, there may not be any symptoms or signs suggesting renal infection and the post-mortem findings may be negative. On the other hand, one may find reported in the literature many cases where a renal infection has apparently developed from an infective process in some other part of the body. (See article, Nierenabscess und Perinephritis, by E. Herszky.)[3]

During the last year I have been conducting a series of experiments on dogs, in regard to renal infection. I tied the right ureter in eight dogs and injected 2 cc. of a twenty-four-hour bouillon culture of *Staphylococcus pyogenes aureus* into the jugular vein. In every instance the kidney whose ureter was tied became the seat of a renal infection and the organism was obtained from both kidneys and the bladder. Three of the dogs died at the end of four and five days from septicemia with renal infection. Two of the other five dogs were killed at the end of two days and I was able to obtain the organisms from both kidneys and the bladder, but *not* from the *blood* or *liver*. In the other three dogs the ureter which had been tied was released at the end of seven days and implanted into the bladder to see if such a procedure could relieve renal infection. In these eight cases the organism, after it had been introduced into the circulating blood, was eliminated by the kidneys and when a ureter was tied its kidney became the seat of renal infection and the other organ might or might not escape, depending on the virulence of the organism, the individual susceptibility, etc.

Long ago Cohnheim,[4] in speaking of the disappearance of organisms from the circulating blood, stated that while some may be destroyed in the blood itself, "it is certain, on the other hand, that they may be excreted from the blood. This can be very beautifully seen in the kidneys of guinea-pigs or rabbits which have died of splenic fever; here it is not uncommon to find some of the bacilli within the loops of the glomeruli, and some outside these, but still within the capsule of Bowman, or they may already have entered the lumen of the uriniferous tubules. In many infectious diseases, moreover, there are present in the kidneys small foci of disease, whose center is formed by a colony of bacteria situated in the interior of a uriniferous tubule, and I can only account for them by supposing an *excretion of micrococci* into the urinary passages and a secondary development there into colonies."

Different results have been obtained by the various investigators who have worked along these lines. Adami[5] has discussed these results and states that he believes that "while one of the functions of the lymphatic glands is to take up and destroy bacteria circulating in the lymph, a function of the liver, both as regards its endothelium and its cells, is to

take up and destroy such bacteria as are introduced by leucocytes into the vessels of the portal system and gain entrance into the portal blood; while similarly, a function of the kidney parenchyma, more especially of the convoluted tubules, is to remove bacteria circulating in the systemic circulation."

Pawlowsky,[6] whose article appeared a year later than Adami's, takes up the consideration of the fate of bacteria from their entrance into the body until their destruction or elimination from it. He reviews the works of previous investigators and gives his own experiments. The latter are very instructive because various organisms were tried and many animals were used, both normal and immunized. Of particular interest is the rapidity with which organisms injected into the subcutaneous tissue may get into the circulating blood and various organs of the body and appear in the urine and bile, and finally disappear from the blood and different organs. He thinks that when organisms gain access to the tissues of the body they may be killed at the portal of entry, and also may, through the lymphatics, be absorbed into the circulation and be quickly eliminated with the urine and bile. On the other hand, they may multiply and give rise to abscesses with subsequent elimination of the infection. When a small amount of antitoxin and bactericidal substances is present, then various foci may appear in the different organs and tissues of the body. In the absence of these substances a general septic infection arises.

If one of the functions of the kidney is that of destroying or excreting organisms which have gained entrance to the circulating blood and are not killed before reaching the kidney, my experiments together with the knowledge that organisms may frequently be found in the circulating blood and urine in acute infections and that renal infection may occur from an infective process in some other part of the body, suggest how in certain cases this takes place. Injury to the ureters in childbirth might bring about a temporary swelling of the ureter, hence a stricture. Should organisms gain access to the circulating blood, conditions would be favorable for renal infection. The presence of organisms in the blood and thence in the kidney may serve as a nucleus for a renal calculus, which, when it attains a sufficient size to injure the kidney or occlude the ureter, may, from the organisms still present or organisms coming from a distant focus, give rise to renal infection. In this connection a very interesting question arises. May the colon bacillus, a very frequent cause of renal infection, and also other organisms, gain access to the circulating blood and be destroyed or excreted by the kidneys without giving rise to any symptoms or in any way injuring the kidney? Animal experimentation suggests that this may take place, for organisms may be injected into the circulating blood and may be found in the kidneys and also in the bladder, and the kidneys appear normal. The presence of organisms in the blood and urine of patients suffering from acute infections also suggests the possibility of the above, for such patients do not necessarily die, and when they do, the kidneys removed afterwards may appear normal.

The physician must bear in mind the relation between the kidneys and infectious foci in other parts of the body, for the finding of organisms in the urine may not indicate renal infection but an infection in some other portion of the body from which the organisms have escaped into the circulating blood and have been eliminated by the kidneys.

As organisms may get into the circulating blood from any focus of infection, either directly by entering the blood-vessels or indirectly through the lymphatics, so they may from inflammatory processes in the bladder. Should a stricture of the ureter be caused by the cystitis, then conditions would be favorable for renal infection from organisms carried by the blood from the bladder to the kidney.

In four dogs I ligated the right ureter and excised from 2 to 3 cm. of it between the ligature and the bladder. The vesical end of the cut ureter was also tied. The bladder was incised and the mucosa was injured and in places removed, care being taken not to injure the ureteral orifices. A small stone was now placed in each bladder and the incision closed. Ten cc. of a twenty-four-hour bouillon culture of *Staphylococcus pyogenes aureus* was injected into the bladder. One dog was killed on the sixth day. In this instance the organism was regained from the blood, liver, gall-bladder, urinary bladder, and both kidneys, and there was a pyonephrosis of the kidney whose ureter had been ligated. Apparently, a general infection had arisen from the bladder, and the kidney whose ureter had been tied became the seat of a pyonephrosis. The other dogs were killed at the end of two to five days, and all cultures except those from the bladder were sterile. Thus the possibility of a hematogenous renal infection arising from a cystitis must be considered.

Aside from the general circulation, the blood-vessels of the kidney communicate with those of the bladder through two other channels, the utero-ovarian vessels and the vessels of the ureter.

B. Vesico-utero-ovario-renal Circulation.

In two post-mortems where I injected the renal artery with a 15 per cent solution of gelatine colored with ultra-marine blue, I found that there was a free arterial anastomosis about the lower pole of the kidney between branches of the renal artery supplying the capsule of the kidney and the branches of the ovarian artery. The ovarian artery in turn anastomoses freely with the uterine and that with the vesical arteries. The veins accompanying the arteries are larger and anastomose freely, and the ovarian vein frequently empties into the renal. There is then both a venous and an arterial communication between the vessels of the kidney and the bladder. In another case I injected the internal iliac artery and through the above-mentioned vessels and the vessels of the ureter the injection fluid reached the capsule of the kidney and a few vessels in the kidney tissue.

C. Blood-Vessels of the Ureter. (See the Ureter.)

II. THE LYMPHATICS.

The lymphatic communication between the bladder and the kidney has been worked out by Sakata, and will be considered

under the ureter as a means of renal infection. In addition the lymphatics probably in many cases act as intermediary channels between the primary focus and the general circulation.

III. THE URETER.

In this connection one must consider the blood-vessels, the lymphatics, and also the lumen of the ureter.

A. THE BLOOD-VESSELS OF THE URETER.

Recent experiments which I have made in regard to the efficiency of the blood supply of the ureter show that there is a means of communication between the blood-vessels of the bladder and kidney through those of the ureter. In a cadaver I inserted a canula into the left renal artery through the incised aorta, and injected the kidney with a 15 per cent solution of gelatine colored with ultra-marine blue. The entire ureter became injected so that on opening the bladder the vessels about the ureteral orifice were also injected. In this instance the ureter was supplied by branches from the following arteries: two from the renal, one from the aorta, internal iliac, middle vesical and vaginal arteries. These branches ran lengthwise in the ureter, in its outer perimuscular coat, and communicated freely with each other, giving off smaller branches to the substance of the ureter. I have injected the renal artery in three other cases, the ovarian in one, the internal iliac in two, and the abdominal aorta in two, first clamping the renal and iliac vessels in the latter two cases, so that the coloring material could not enter these vessels. All these cases demonstrated the free anastomosis of the arteries of the ureter, and also that any one artery is probably able to supply the entire ureter. The blood supply of the ureter is variable and may be derived from the aorta, the renal, ovarian, iliac, uterine, vesical and other arteries. The veins are larger, less tortuous than the arteries and follow nearly the same course. Therefore, the possibility of infection passing from one organ to the other through these channels may be considered.

B. THE RELATION BETWEEN THE LYMPHATICS OF THE KIDNEY, URETER AND BLADDER.

Sakata,[7] who has been working in Mikulicz's clinic at Breslau on renal infection arising from the bladder, has endeavored to demonstrate whether or not there was a lymphatic communication between the bladder and the kidneys through the lymphatics of the ureter. He chose infants as subjects, and used the Gerota injection mass. His conclusions are as follows:

1. Lymphatic channels in the mucosa and submucosa of the ureter could not be demonstrated.

2. Lymphatic vessels were present in the muscular layers and in the outer coats of the ureter, and these for the most part ran parallel with the blood-vessels.

3. The efferent lymph-vessels were present for the most part, in the middle of the ureter and led to the lumbar lymph-nodes which lie along the aorta, the inferior vena cava, and mesial to the common iliac artery.

4. The lymph-vessels of the lower portion of the ureter either emptied into the hypogastric lymph-nodes or united with the lymph-vessels of the bladder.

5. In the upper portion of the ureter, the lymph-vessels extending to lymph-nodes could not always be demonstrated, but when so they led to the nodes about the aorta. Otherwise, the lymph-vessels of this portion of the ureter passed over into those of the kidney.

6. The communication between the lymphatics of the bladder and kidney was not direct but existed either by means of the local glands of the bladder and kidney or by means of the lymph-vessels of the ureter.

In view of the fact that one is able at post-mortem to determine the fate of dust inhaled by the individual from its deposit in the lung tissue and bronchial lymph-nodes, I thought that experimentally I could use a similar method in detecting the relation between the lymphatics of the bladder, ureter and kidney.

In one dog I opened the bladder and cut away the mucosa from the right ureteral orifice. The incision in the bladder was closed and the bladder was distended with a gum acacia suspension of lamp-black introduced through a hypodermic needle by means of a syringe. This was followed by 10 cc. of a 24-hour bouillon culture of *Staphylococcus pyogenes aureus*. The dog was killed at the end of five days. Cultures were taken from both kidneys and bladder, and the organism was regained from the bladder while the cultures from the kidneys were sterile. Both ureters were cut into pieces 5 mm. long, and these were arranged in order on end and thus embedded in celloidin and cut. I was unable to detect any lamp-black in any part of the ureter, the pelvis of the kidney, or the kidney itself. I had hoped that the injury to the ureteral orifice would permit the lamp-black to gain access to the lymphatics of the ureter and that I should be able to recognize the particles under the microscope and thus trace it. In seven other dogs I made a uretero-vesical implantation on the right side and filled the bladder with lamp-black and a bouillon culture of the staphylococcus, as in the first instance. One dog died on the third day from general peritonitis due to a tearing away of the ureter from the bladder. Pyonephrosis of the right kidney was present. Another dog died on the sixth day with bilateral renal infection. The left ureter had been isolated and gauze wrapped about it, thus causing a stricture, and the right ureter had been implanted as in the other case. In the other five cases the dogs were killed at the end of four, five, twelve, and forty-two days. In these cases there was evidence of renal infection in only one; namely, the one killed at the end of forty-two days, where there was a pyonephrosis on the right side. In this case and the others cultures from the left kidney were sterile. In the other four cases cultures from the right kidney were also sterile, while the organism was regained from the bladder in each instance. Sections of the bladders, ureters and kidneys showed the lamp-black only in the bladders and not in the ureters or kidneys.

My experiments, as far as the demonstration of the lymphatic communication between the bladder, ureter and kidney were concerned, were negative.

Before considering "The Lumen of the Ureter as an Avenue for the Transmission of Infection from the Bladder to the Kidney," it is necessary to understand the anatomy and physiology of the normal ureter and especially of the vesical portion of it in so far as they are related to ascending infection.

I. ANATOMY OF THE URETER.

The ureter is a flexible, contractile tube, extending from the pelvis of the kidney to the bladder. It is an active organ and in passing from the kidney to the bladder, changes its course and is crossed by other structures, all of which cause irregularities in its form. These irregularities consist of constrictions and consequent dilatations between them. The first constriction is situated a short distance below the pelvis of the kidney, and Glantenay speaks of this as the neck of the ureter rather than the neck of the pelvis, as it is usually called. The terminal constriction is situated at the point where the ureter enters the bladder. Other constrictions may occur in the ureter between these places, as where it bends over the iliac vessels. Cruveilhier [8] thought that these dilatations and constrictions were inconstant, but Glantenay [9] states that they are always present, although presenting slight variations, and that they are dependent on the functional activity of the ureter, for he states that they are absent in the fœtus. The constrictions are of importance as offering resistance to the passage of renal calculi, and Van Hook [10] has called attention to the liability of surgeons considering these physiological strictures to be pathological. The spindles act as reservoirs for the urine, and frequently in slowly withdrawing a renal catheter one can tell when the end of the catheter reaches one of these reservoirs, for then there occurs an increase in the amount of urine coming from the end of the catheter. These constrictions and spindles often become much exaggerated in cases of obstruction to the ureter; and a frequent cause of hydro-ureter and renal infection is cystitis which increases the stenosis normally present at the entrance of the ureter into the bladder.

The walls of the ureter contain longitudinal and circular muscular coats and the lumen is lined with stratified epithelium similar to that of the bladder. From its structure one can seen that it is well adapted to its function, namely, of conveying the urine from the kidney to the bladder.

From the standpoint of ascending renal infection the vesical portion of the ureter is most important. This portion of the ureter must be studied under all physiological conditions of the bladder. I looked up the literature in regard to this point and was unable to find what I wished, so during the last year I hardened human bladders under various conditions; as, distended, collapsed, contracted, and also by forcing fluid into the contracted and distended bladders. Some of these bladders were hardened by introducing formalin into the bladder through the urethra just after death and removing the organ later, but most of them were fixed after removing the organs at autopsy. From these specimens the intravesical portions of the ureters were removed and these were studied by cutting them into longitudinal, cross and tangential sections. Other ways of studying the relations between the two were used; as, gross dissection, placing in glycerin and by maceration with nitric acid.

If one will dissect free the ureters and bladder from the adjacent structures and open the bladder so as to expose the trigonum, the ureteral orifices can be seen, sometimes as mere slits, and other times as oval openings. Between the ureteral orifices can usually be seen a band connecting the two, which is known as the intra-ureteric band or fold. By making traction on the ureter it will be seen that the ureter apparently passes through the bladder as a separate organ to be inserted into the mucosa of the latter; for in doing this the mucosa is retracted and beneath it can be seen fibers apparently extending from the end of the ureter out over the trigonum, the so-called roots of the ureter. Disse [11] claims that the origin of the intra-ureteric fold and roots of the ureter from a prolongation of the muscles of the ureter is only apparently so. He has shown on serial cross-section of the vesical portion of the ureter that the muscle bundles of the ureter gradually diminish as one approaches the ureteral orifice and that these are replaced by fibrous tissue. The ureteral muscles end in the submucosa and mucosa of the bladder near this orifice and new muscle bundles arise in the submucosa of the bladder near the place where the ureteral muscles end and are separated from the latter by a small amount of connective tissue, and have a similar direction and appearance to the ureteral muscles. These new muscle-fibers give rise to the intra-ureteric band and the so-called coats of the ureter, which can be seen beneath the mucosa of the fresh specimen or the one which has been preserved in glycerin, when traction is made on the ureter. A specimen which has been macerated in nitric acid brings out very well the relation between the ureter and bladder. The intra-ureteric band and the roots of the ureter in such specimens apparently arise from the ureter and not from the bladder. The difference in the muscular structure of the bladder proper and the trigonum is well shown, the large muscle bundles and coarse meshwork of the former as contrasted with the finer bundles and compact structure of the latter. The difference in structure between these two has been very carefully studied by Griffiths.[12]

Is the relation between the ureter and bladder the same under all conditions; i. e., what effect have the various degrees of distention of the bladder and the varying amounts of intravesical tension on the vesical portion of the ureter? If one will examine the bladder of a patient (woman) through an open cystoscope, a very good idea can be obtained of some of the changes which the bladder undergoes during contraction. When a patient assumes the knee-breast, elevated dorsal or Sims' posture,[13] and an open cystoscope is introduced into the bladder, usually the bladder becomes distended and one can view the entire bladder. Now ask the patient to try to urinate slowly. Frequently one can see the bladder gradually

contract, the cavity becomes smaller and smaller, while the mucosa becomes thrown into folds which partially occlude the lumen of the contracted bladder. When the patient relaxes, the bladder again becomes distended by atmospheric pressure. If, on the other hand, the patient is told to try to urinate quickly, another phenomenon is frequently seen; viz., the increased intra-abdominal pressure forces the posterior bladder wall against the mouth of the urethra (the cystoscope in this instance) and the bladder becomes collapsed before it has had time to contract. Had urine been present in the bladder, its resistance would have permitted the two processes to act together. Thus can be demonstrated two important features associated with the process of urination; the contraction of the bladder itself and the part played by bearing down, i. e., by increasing the intra-abdominal pressure.

If a patient's bladder is emptied before an operation in the pelvis, one can study the condition of the bladder, and here one will usually find a collapsed bladder—a condition often seen at autopsy and in the sagittal sections made of frozen bodies. In this condition the cavity of the bladder and the lumen of the urethra form a Y-shaped cavity, usually with a long anterior limb and a short posterior one. On the other hand, one sometimes finds at autopsy a contracted bladder which protrudes into the abdominal cavity with a form similar to a large hen's egg. On section the lumen is found to be very small and partially occluded by folds of the mucosa of the bladder and is continuous with that of the urethra. The bladder contracts in order to expel the urine and then relaxes, as I have described in the cystoscopic examinations. Between the acts of urination the bladder is a flaccid sac, which becomes gradually filled with urine and becomes tense only when it contracts or the distention becomes very great. When one finds at autopsy the contracted bladder it probably means that certain stimuli have caused the bladder to assume this form.

We must consider the vesical portion of the ureter under the following conditions:

1. The distended bladder.
2. The contracted bladder.
3. The collapsed bladder.

The Distended Bladder.

When the bladder becomes distended it is converted into a thin-walled sac. The mucous membrane becomes smooth except where here and there muscular bands may cause slight elevations. The greatest amount of distention takes place in the fundus, as indicated by the structure of the same. This is well shown by comparing the thickness of the bladder walls in Figs. I and II. The trigonum changes much less, as could be inferred from its structure, and is also shown in the two illustrations above referred to. In the distention of the bladder the fundus rises and may appear above the symphysis as an oval tumor, and at the same time it distends backward so that it causes the vagina to bulge. Hence the importance of dilating the vagina first when cystoscopic examinations are made, so that this backward and downward displacement will be prevented and the trigonum can be the more readily seen through the cystoscope. The ureter terminates in the mucosa of the bladder at the angle of the trigonum and is fixed there by the insertion of its muscles in the mucosa about its orifice and also by the so-called roots of the ureter. The trigonum is less distensible than the fundus and when the bladder dilates backward and the trigonum is pushed downward the relation between the ureter and the bladder changes. The course of the ureter through the bladder becomes more oblique and the bladder mucosa above the ureteral orifice is stretched, and as the orifice itself is fixed, this stretching of the bladder mucosa and more oblique course of the ureter through the bladder wall pulls out the anterior ureteral lip and elongates the so-called ureteral valve. (Compare Figs. I and II.)

The lumen of the ureter becomes converted into a flattened canal, as shown by Figs. I and V, and one can see how that any intra-vesical tension would force the anterior lip of the ureter or valve against the posterior ureteral wall, thus occluding the lumen of the ureter. The ureteral orifice itself varies in different cases. It may be a longitudinal slit with the two ureteral labia, the prolongation of the lateral wall of the ureter in close apposition; in other cases, the opening is oval or round and there may be a continuation of the lumen of the ureter below this opening, forming a pouch. In still other cases the labia diverge, forming an opening like an inverted V or U. As one would infer, the microscopic study of these different openings would give different pictures, but the same general principles apply in all. Increased intra-vesical tension would force the valve against the posterior wall of the ureter and in some cases the labia would also be forced together, affording an additional security.

The Contracted Bladder.

The difference in structure between the distended and the contracted bladder is well shown by comparing Figs. I, III and V with Figs. II, IV and VI. The walls of the contracted bladder are much thicker, due to the contraction and thickening of the muscular bands, and the lumen is more or less occluded by the rugæ or folds of mucous membrane. The ureter passes through the walls of the bladder less obliquely, and its mucosa is thrown into folds. The ureteral orifice being a part of the bladder mucosa is also thrown into folds and one can see that the ureteral valve is the anterior lip of the ureter covered by the bladder mucosa. The labia may be very distinct, as shown in Fig. IV. The prevention of a reflux of fluid from the bladder is apparently mainly brought about by the puckering of the ureteral orifice and any intra-vesical tension would occlude the ureteral orifice, as shown in Fig. VII. In the contracted bladder the ureteral valve and the oblique course of the ureter apparently play a less important part in the prevention of a reflux of urine than they do in the distended bladder. In the collapsed bladder the relation between the ureter and bladder resembles more nearly that of the distended than that of the contracted bladder.

Intermediate conditions of the bladder would show corresponding changes in the vesical portion of the ureter.

II. PHYSIOLOGY OF THE URETER.

The function of the ureter is to convey the urine from the kidney to the bladder. This is brought about mainly by the peristaltic contractions of the ureter and the pressure caused by the secretion of urine. Other factors assist in this, as the gravity of urine when a person assumes the erect posture, contractions of the diaphragm, peristalsis of the intestines, pulsation of arteries crossing the ureter, and contraction of the abdominal muscles.

Much may be learned from clinical material in regard to the physiology of the ureter. The ureter is frequently seen during operations, and it can be seen to contract, and this may frequently be brought about by pinching the ureter with forceps.

I studied the ureteral orifices and the changes which they underwent during contraction of the ureter in ten women. The patients were placed in the Sims posture, it being more comfortable for them than the knee-breast position, and the observations were made through an open cystoscope. The urine is forced from the ureters into the bladder in spurts at intervals. These intervals vary and undoubtedly are more or less dependent on the rate of secretion of urine. There may be great variations in one ureter, as, in observing ten contractions of the ureter, I found that they occurred at intervals varying from 14 to 38 seconds. On the other hand, the intervals may be very regular, as from 13 to 15 seconds for 10 observations. I have studied the same cases on different days, and in one case in which I made observations on three different days, the right ureter contracted more frequently than the left, and while the rate for each ureter was different from the other and was also different on each day, yet at any one time there was but very little variation in the intervals between the contractions. In one patient (Gyn. No. 10717), who had a nephrectomy three and one-half years ago, the ureter from the remaining kidney contracted at intervals of 15 to 27 seconds for 10 observations. The duration of the contraction lasts from 3 to 6 seconds in the cases in which I have recorded it. During the contraction of the ureter, but very little change takes place in the form of the ureteral orifice until the jet of urine appears; possibly it bulges a little, the bulging being caused by the column of fluid in the lumen. It now retracts and the urine is shot forth. The final step in the process and the most interesting one is that apparently the further contraction of the ureter shuts off the ureteral orifice, by drawing it in, and one can see that there is distinct traction on the roots of the ureter. The ureter now relaxes and the orifice assumes its position of rest, and occasionally the contraction is duplicated. According to Engelmann,[14] who is quoted in many of the text-books—and while his article was published in 1869, but very little has been added to it—the contractions of the ureter start from the renal end and go toward the bladder. He thinks that these originate in the muscular tissue independently of any intrinsic or extrinsic nerves, and the stimulus is transmitted from muscle-cell to muscle-cell. Just what the form of this stimulus is, seems to be a disputed question.

The following experiments which I have made throw some light on the cause of these contractions:

Experiment No. I.—The kidneys, ureters and bladder of a dog were removed and placed on a tray, and no attempt was made to imitate physiological conditions. A canula was fastened in the pelvis of one kidney and this was connected by rubber tubing with a funnel. Water, colored by Loeffler's methylene blue, was placed in the funnel and the funnel was elevated so that the fluid flowed through the ureter into the bladder. As long as the fluid flowed through the ureter, contractions occurred, and these would cease as soon as the tubing was clamped, thus stopping the flow. This was kept up for one hour without any attempt to imitate physiological conditions other than keeping the specimen moist. Contractions began at the renal end and traveled down the ureter, the lumen of the ureter becoming occluded during the contractions. The ureter became much shorter and at the end of the contractions would relax and sag down, again to become filled with fluid preparatory to the next contraction. These contractions occurred every 1½ to 2 minutes in this specimen, and I was unable to change the rate by elevating the funnel, i. e., by increasing the pressure of the fluid.

Experiment No. II, as in No. I, except that the specimen was kept moist with warm, normal salt solution and salt solution was used in the funnel. The first five contractions were at intervals of from 1 to 2½ minutes. The bladder was then filled with fluid and the urethra was clamped, so that the ureter had to work against an overdistended bladder. The contractions became more frequent, every 10 to 20 seconds, and the ureter did not completely empty itself, and occasionally a contraction would be duplicated. The clamp was removed from the urethra and the bladder was emptied and the contractions became slower, every 30 to 40 seconds. The ureter was now clamped near the bladder and 10 contractions occurred during the first minute. The ureter then became distended and ceased to contract, although I waited several minutes. The clamp was removed and again the ureter began to contract.

Experiment No. III.—Dead dog. Organs in situ, otherwise as Experiments Nos. I and II. The ureter contracted every 1 to 1¼ minutes and the rate could not be changed by the elevating of the funnel, but occasionally a contraction would be duplicated.

Experiment No. IV.—As above, except the dog was living and under ether. Contractions occurred every 50 to 70 seconds, increasing to every 30 to 40 seconds when the bladder became distended and, by elevating the funnel, to every 15 to 20 seconds. Normal salt solution colored with aqueous methylene blue was used, and no matter what the elevation of the funnel, when the ureter contracted it became white, showing that the lumen was occluded. In another dog who had just been killed I was unable to make the ureters contract by this method.

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BALTIMORE, MD.

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I made the following experiments, which have a bearing on these cases:

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I have mentioned my own observations and those of others in regard to the anatomy and physiology of the ureter, only in so far as I thought that they would have a bearing on ascending renal infection. The best accounts which I found were in the writings of Disse,[11] Boari[16] and Glantenay.[9] Morris[15] contains the best description in the English language.

C. The Lumen of the Ureter as an Avenue for the Transmission of Infection from the Bladder to the Kidney.

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The following ways of an ascending infection taking place must be considered:

I. From injuries to the ureteral orifice, thus permitting the entrance of organisms into the ureter.

II. From an extension of an inflammatory process from the bladder through the ureteral wall or along the lumen of the ureter.

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I realize that these experiments are too few in number and also too variable to draw any absolute conclusions from, but they suggest that the contractions of the ureter are dependent on the functional activity of the kidney and that the chief stimulus is fluid, without regard to its chemical constituents, running into or through the lumen, for in these experiments the contractions always ceased when the fluid was shut off and were resumed on letting it run again. Many experiments could be done along this line, as, introducing foreign bodies into the lumen and seeing what effect they had, and also reversing the current, i. e., by inserting the canula into the vesical end of the ureter. In one instance I was able within one hour after death to insert a canula into the pelvis of the kidney of a human being, but was unable to make the ureter contract.

There are many other interesting points in regard to the anatomy and physiology of the ureters, many of which have not as yet been worked out. One of the latter is the function of the sympathetic nerves about the ureter. In the more extensive operations for cancer of the cervix of the uterus, the ureters are dissected free and many ganglia and nerves situated in the parametrium about the ureter are destroyed. Could this have anything to do with a post-operative ureteral fistula, cystitis and ascending renal infection which only too frequently follow such operations?

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I. Injuries to the Ureteral Orifices.

The following cases show how renal infection may occur from injuries to the ureteral orifice:

Miss K. K., age 21 (Gyn. No. 9966), was admitted to this hospital with symptoms suggesting tuberculous cystitis. Tubercle bacilli were found in the urine and on cystoscopic examination the bladder was found to be the seat of a very extensive tuberculous process. A vesico-vaginal fistula was formed in order to relieve the bladder, and the entire bladder was curetted. The curettings showed tuberculous tissue. A retention catheter was placed in the bladder and the patient was put in a tub and continuous irrigations were given through the catheter. The patient felt well at first, but gradually began to feel badly, and at the end of four weeks it seemed evident that there must be renal infection on the left side. The kidney and ureter of that side were removed. I stained many sections of both ureter and kidney for tubercle bacilli and was unable to find any. The kidney contained many small abscesses, which at operation were thought to be tuberculous, but on microscopic examination were shown not to be so, but due to a bacillus having the morphology and staining properties of the colon bacillus. I was able to demonstrate large numbers of these organisms in these abscesses. The ureter was much thickened and showed changes which would be caused by a stricture of long standing. The acute renal infection possibly occurred as follows: There was a tuberculous cystitis, probably secondary to tuberculosis of the left kidney (patient died eight days after operation and the other kidney was found to be tuberculous); this cystitis caused a stricture of the vesical portion of the right ureter. The bladder was curetted in the presence of infection, which meant that the ureteral orifice was probably injured, and so the organisms were able to gain entrance to the ureter. The stricture of the ureter interfered with the function of the kidney and also permitted a mixing of the urine in the lumen of the ureter with the organisms present, and thus renal infection occurred. Of course, the possibility of the organisms gaining entrance to the circulating blood by the curettage and hence to the injured kidney—the one with the strictured ureter—must also be considered. Possibly tubercle bacilli were also carried to the kidney, but the acute process was caused by the other organism.

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Cultures from the kidneys were sterile. Organism was regained from the bladder.

In nine dogs I resected a ureter and implanted it in the bladder; the bladder was then filled with a sterile colored solution to see if there was a reflux into the ureters and also with 10 cc. of a 24-hour bouillon culture of *Staphylococcus pyogenes aureus*. No reflux took place into either ureter. Two of the dogs died. One died at the end of four days, from general peritonitis due to leakage about the implantation. Renal infection occurred on the side of the implantation. The second dog died from bilateral renal infection. The ureter had been implanted and a piece of gauze had been placed about the other in order to cause a stricture of the ureter. The other seven dogs were killed from four days to six weeks, and in only one was there renal infection as shown by cultures and microscopic study of the kidneys. Renal infection occurred in three of the nine cases and in these cases there was a marked stricture at the seat of the implantation.

Injury to the ureter in the presence of infection may not necessitate renal infection, but something additional is usually necessary, and undoubtedly a stricture of the ureter is the commonest accessory factor, for it interferes with the function of the kidney and causes a stagnation of urine, so that the infected urine may reach a weakened kidney. A stricture of the ureter was present in both of the cases in which it occurred in human beings, one from the cystitis and the other from the uretero-vesical implantation as it was made under tension, 4 cm. of the ureters having been excised with the growth. Still, in both cases one cannot exclude other means of renal infection, but the injured ureteral orifices, in one case curetted, and in the other, the newly implanted ureter, would certainly interfere with the natural protection usually afforded by this portion of the ureter.

II. EXTENSION OF AN INFLAMMATORY PROCESS FROM THE BLADDER THROUGH THE URETERAL WALL OR ALONG THE LUMEN OF THE URETER.

This is very well shown in Fig. VIII, which represents the right ureteral orifice from a patient dying from renal infection secondary to a post-operative cystitis. Mrs. C. F., age 62 (Gyn. No. 10432). I did a radical operation for carcinoma cervicis uteri without resection of the ureters. The lymphatics were dissected from the pelvic walls and removed *en masse* with the uterus, the ureters having been dissected free from this mass. The patient died on the ninth day, without any localizing symptoms. Autopsy showed extensive cystitis and purulent nephritis of the right kidney. In Fig. VIII one can see how the infection has apparently passed through the bladder and ureteral wall, thus reaching the lumen of the ureter. The ureteritis caused a swelling of the ureter, hence a stricture. The stricture interfered with the function of the kidney, hence predisposed it to infection and also interfered with the function of the ureter, causing a stagnation of infected urine in its lumen which was able to reach the weakened kidney. In addition, the function of the intravesical portion of the ureter was interfered with, for the ureteritis converted it into a sinus, thus permitting a reflux of urine from the bladder into the ureter.

The above is an example of probably a frequent means of ascending infection, i. e., by the extension of the infection into the lumen of the ureter and the interference with the function of both ureter and kidney by the swelling caused by the ureteritis and thus carrying the infected urine to the injured kidney.

III. ORGANISMS TRAVELING UP THE URETER.

Orth [17] thinks that organisms may travel up the ureter, either by means of their motility or by a growth along the lumen of the ureter, and Jacobelli also suggests this,[18] and thinks that the current of the urine from the kidney to the bladder is the best protection against renal infection from the bladder. When this is interfered with, as by a stone in the ureter or a ligated ureter, an infection may occur not from a reflux from the bladder but from the organisms traveling up the portion of the ureter below the injury.

IV. REFLUX OF URINE FROM THE BLADDER INTO THE URETERS AS A CAUSE OF RENAL INFECTION.

Three ways of bringing this about must be considered:

A. From intra-vesical tension.

B. From reverse peristalsis.

C. From suction of the air into the ureters through an open cystoscope when patients are examined in the knee-breast posture.

Experiments have been made on animals in regard to the reflux of urine from the bladder into the ureters.

Lewin and Goldsmith [19] showed that in anæsthetized rabbits colored solutions, such as milk and methylene blue, and likewise air, could be seen to pass from the bladder into the ureters under various degrees of distention of the bladder. This phenomenon occurred both when the colored solutions were injected into the bladder and when artificial retention was caused. This seemed to be dependent on an over-distention of the ureters with fluid and also on a reverse peristalsis on the part of the ureter. These authors have written other articles based on these experiments which have been reviewed by Marcus.

Courtade and Guyon [20] repeated the experiments of Lewin and Goldsmith, using both rabbits and dogs. They found that while a reflux occurred frequently in rabbits, that in dogs it was much less frequent.

Jacobelli claims that colored solutions may pass from the bladder into the ureters of rabbits when the solution is suddenly injected into the bladder.

Young [21] has discussed at some length the experiments of Lewin and Goldsmith and also those of Courtade and Guyon, and refers to two instances where he was unable to bring about a reflux of colored fluid from the bladder into the ureters of dogs, by distending the bladder with colored solutions.

Stoeckel [22] placed a catheter in the bladder of a dog, and after exposing the ureter, permitted the bladder to be filled with a solution of methylene blue, and at the same time caused

the ureter to contract by pinching it with forceps. The ureter contracted, but a reflux did not occur. The dog was killed three days later and traces of the coloring material could not be found in either ureter, but were found in the bladder. In another experiment he exposed and cut one ureter of a rabbit and injected coloring material into the bladder. The urethra was ligated and after thirty-six hours the bladder ruptured, but there was no trace of the coloring material in either ureter.

Marcus [23] repeated the experiments of Lewin and Goldsmith, and showed that a reflux frequently occurred in rabbits, due either to anti-peristalsis of the ureters or through bladder contractions when the ureters are overdistended or injured. I have made the following experiments relative to a reflux from the bladders into the ureters of dogs:

In seven dogs I resected one ureter of each and implanted it into the bladder and then filled the bladder with a gum acacia suspension of lamp-black introduced into the bladder by means of a hypodermic needle and aspirating syringe. In some cases the coloring material was introduced slowly and in other cases suddenly and forcibly. In addition, 10 cc. of a 24-hour bouillon culture of *Staphylococcus pyogenes aureus* was also injected into the bladder with a hypodermic syringe. In two instances the urethra was tied for one hour. The vesical end of the resected ureter was not tied in any of the cases. During the operation a reflux did not occur into either the intact ureter, the vesical stump of the resected ureter, or into the reimplanted ureter. The above was tried on two other dogs, using an aqueous solution of Prussian blue instead of the suspension of lamp-black, but the results were negative. In four of these cases the ureters were cut into pieces 5 mm. long, placed on end and cross-sections made. Thus a section from every 5 mm. of the ureter was examined. In not a single instance was there any evidence of the lamp-black or blue found in the ureter. In every instance sections were made of the pelvis of the kidney, and no evidence was found of the coloring material used. On the other hand, traces of the lamp-black could be found in the bladder at the seat of the implantation. Cultures were made from the kidneys and in only one of the nine cases was the organism regained from the kidney whose ureter was not reimplanted, and in that instance a piece of gauze had been placed about the ureter, causing a stricture. In this instance the organisms may have gained access to the kidney through the circulating blood. In three of the nine cases the kidney whose ureter had been reimplanted became infected, and in all three there was a marked stricture at the place of the implantation. In all cases the organism was regained from the bladder. In five other cases where I have implanted both ureters into the bladder and have not tied the vesical stumps and have filled the bladders with a coloring solution, in no instance did a reflux occur through the vesical stumps or into the implanted ureters. Realizing that according to some observers the active peristalsis of the ureter is necessary for a reflux from the bladder into the ureters, I anæsthetized a dog, injected a few cubic centimeters of a deeply colored solution of methylene blue into the bladder and then inserted a canula into the pelvis of one kidney and permitted normal salt solution to run slowly into the ureter. The ureter contracted as has been described under the experiments on the physiology of the ureter. The bladder was thus slowly filled and at no time did a reflux occur from the bladder into the ureter for it could have been easily seen through the thin-walled ureter of a dog.

Courtade and Guyon claimed that when the band of muscle-fibers which curve over the vesical portion of the ureter of a dog are cut, then the reflux will occur as easily in the dog as in the rabbit. As stated, in fourteen dogs where I have resected the ureter and reimplanted it in the bladder and then filled the bladder with a colored solution, in no instance did a reflux occur from the bladder into the newly implanted ureters. In five of these instances the implantation was double, thus making in all nineteen implanted ureters. The implantation may have compressed the ureter, thus interfering with a reflux, but in only three of the nine cases, where organisms were introduced into the bladder, was there a marked stricture, and in these cases renal infection occurred. Great distention of the bladder was not tried for fear of injuring the operation. Nevertheless, the bladders were distended as greatly as I have ever found them in a dog at operation, and in some cases there would be a leakage about the implantation wound, but I never saw a reflux take place. The ureters were implanted into the bladders by a method previously described by me.[1] In three dogs ascending renal infection occurred, but I think that the stricture caused by the implantation in the presence of the infected bladder was probably the main accessory etiological factor. In another case where I curetted the mucosa from the ureteral orifice and filled the bladder with a colored solution, and injected 10 cc. of a twenty-four-hour bouillon culture of *Staphylococcus pyogenes aureus,* a reflux did not occur, nor did renal infection take place. The bladders, ureters and kidneys of the dogs, in which a ureteral implantation was done, were removed from four days to six weeks after the operation, and in six instances I filled the bladders with fluid and was unable to force fluid from the bladder into either ureter in any of the cases tried.

I have never been able to bring about a reflux of urine from the bladder into the ureter of dogs with an intact or injured ureteral orifice, nor have I ever observed a reverse peristalsis on the part of the ureters. The question arises, why did it not occur in the cases where the ureter is implanted in the bladder? I think that in these instances the intact ureteral mucosa at the opening into the bladder is the main preventive. The ureters were not only implanted in the sides of the bladder but also into the fundus, and while the end was split into two flaps, no attempt was made to imitate the natural course of the ureter through the bladder, as has been described by Budinger [24] and first used by Witzel [25] in human beings.

A reflux of fluid from the bladder into the normal ureter of dogs must be rather unusual if I have been unable to bring it about at the time of the operation in sixteen dogs; and in

thirteen dogs, where cultures were placed in the bladder and the dogs killed at intervals of from two to four days; in only one were the organisms regained from the kidney whose ureter was intact, although they were obtained in every instance from the bladder, and in that one case they were also present in the heart's blood and liver, thus probably indicating a general infection from the injured bladder. And even in the injured ureter a reflux did not occur at the time of the operation in nineteen uretero-vesical implantations and in one other case where the ureteral orifice was curetted. In only three of nine cases where the ureter had been resected and implanted in the bladder and organisms introduced into the bladder, did renal infection occur.

The Occurrence of a Reflux of Urine from the Bladder into the Ureter in Human Beings.

It is not safe to draw definite conclusions in regard to man from animal experimentation. Courtade and Guyon found that a reflux might occur in rabbits but was much less frequent in dogs. Conclusions drawn from experiments on rabbits would not hold on similar experiments on dogs, and so any definite conclusions in regard to man would not be justifiable from these experiments.

From a study of the anatomy and physiology of the ureters and bladder in man it would seem that the normal physiological function of the ureters is to convey urine from the kidneys to the bladder and also to prevent the urine from passing from the bladder into the ureters, and thus interfering with the function of the kidneys.

No matter what may be the condition of the bladder, whether distended, collapsed or contracted, and under all degrees of intravesical tension, there is apparently present especial provision for the prevention of this reflux, as I have described. Frequently, here in this hospital, urine cultures have been made from the bladder and both kidneys, and urine from one kidney would be sterile and that from the other kidney and bladder would be infected, thus suggesting a unilateral renal infection; or the cultures from both kidneys would be sterile and that from the bladder positive. Similar cases have been reported by Brown.[26] *If a unilateral renal infection exists and is constantly pouring infected urine into the bladder, or if a cystitis is present, one would think that the urine from the kidneys would be contaminated if a reflux was possible.* Distention of the bladder with fluid very rarely causes pain in the kidney region which would occur if a reflux were possible, for an excellent means of locating a renal pain is to distend the pelvis of the kidney with fluid introduced through a renal catheter, as has been reported by Kelly.[27] A very common way of making a differential diagnosis between an uretero-vaginal and a vesico-vaginal fistula is to fill the bladder with some colored solution. If a vesico-vaginal fistula is present the solution will appear in the vagina; on the other hand, according to our experience, when an uretero-vaginal fistula alone exists the fluid will not appear. In a few cases the ureter has been catheterized through the bladder, showing that it was not occluded and that there must have been a prevention of reflux from the bladder by the anatomical mechanism of the ureteral orifice. In two cases where I have resected the ureters and reimplanted them into the bladder, I filled the bladder with a solution of methylene blue and a reflux did not occur, either from the vesical stumps of the ureter which had not been tied or into the implanted ureters.

In another case, Mrs. A. H. P. (Gyn. No. 10617), from whom three weeks before I had removed a large renal calculus which filled the pelvis of the kidney, I placed in the bladder a few cubic centimeters of a concentrated solution of methylene blue, and then placed several pledgets of absorbent cotton in the pelvis of the kidney through the lumbar incision. The patient was asked to refrain from voiding as long as she could. She was able to retain her urine ten hours and at the end of that time voided 600 cc. of urine, stained deeply with the methylene blue, yet the nephrotomy wound was examined and no trace of the coloring material was found. The ureter, however, was patent, as I had catheterized it on the previous day and had been able to inject fluid through it and the fluid appeared in the lumbar incision.

In contradiction to the above observations and study of the anatomy and physiology of the ureter, cases have been reported where apparently a reflux has occurred in normal conditions. Pozzi[28] injured the ureter in the removal of a large intraligamentary cyst. Both ends of the ureter were brought into a skin incision, as he intended later to remove the kidney. Urine came from both ends of the cut ureter, thus apparently demonstrating the presence of a reflux from the bladder. Modlinsky[28] cut a ureter in a hysterectomy by the Kraske-Hochenegg method. Patient died in 3 days and nearly all the urine came from the wound. At autopsy, the entire urinary tract except the cut ureter was apparently normal.

One may find a few isolated cases reported, where a reflux has apparently occurred, but these certainly are the exception and one suspects a diseased ureter or some abnormality.

A Reflux of the Urine from the Bladder into the Ureter may sometimes Occur under Pathological Conditions.

When the intravesical portion of the ureter becomes invaded by an inflammatory process, it may become converted into a rigid tube and is not influenced by the various conditions of the bladder, and cannot be collapsed by intravesical tension. Its function is, therefore, interfered with, and if in addition, the mucosa is diseased, the ureter is no longer a collapsible, contracting tube but is converted into a sinus and all means of preventing a reflux of urine from the bladder into the ureters may have been removed, except the pressure of the urine coming from the kidneys, and this can be easily overcome by forcible contraction of the bladder or by distending the bladder with fluid.

As is well known, if the bladder and ureters are removed

intact at post-mortem, fluid cannot be forced into the ureter from the bladder in normal organs. In one case I took a bladder which had just been removed from an autopsy subject and cut off both ureters near the bladder. The bladder was distended with fluid and a reflux did not occur from either ureter. A renal catheter was introduced into one ureter and local applications of formalin were made to the ureter. I waited an hour, and after removing the catheter from the ureter a reflux took place through the ureter which had been hardened by the formalin.

Case I.—In April of this year I operated on a patient for carcinoma cervicis uteri (Gyn. No. 10432). In the operation I removed the pelvic lymph-glands *en masse* with the uterus and growth, thus removing all the tissue from pelvic wall to pelvic wall, except the ureters and large vessels. The ureters were dissected from the parametrium and from the vesico-vaginal and utero-vaginal plexus of veins. It was necessary to sacrifice a portion of the outer coat of the bladder, as it was very adherent to the growth. All raw areas were covered with peritoneum and two small drains were placed on either side of the pelvis and out through the vagina. As the outer coat of the bladder had been injured, a retention catheter was placed in the bladder. The patient died on the ninth day without any localizing symptoms or pain. At autopsy there was found to be a diffuse purulent nephritis of the right kidney, while the left kidney was not involved. Fluid forced into the bladder appeared in the pelvis of the diseased kidney, but could not be forced into the ureter of the other kidney. The bladder was opened and there was found to be a patchy cystitis. The intravesical portions of both ureters were excised, and Fig. VIII is a drawing made from a longitudinal section of the infected one and Fig. IX, from a longitudinal section of the other. One can see the inflammatory condition of the bladder mucosa in the upper portion of Fig. VIII, and how this has extended through the bladder wall, invading the muscle bands and inter-muscular tissue. Apparently by direct extension, the ureteral wall had become invaded, and thus the ureteral mucosa. The ureteritis caused a stricture and thus interfered with the function of both kidney and ureter, and the urine in the dilated ureter became contaminated from the organisms causing the ureteritis. Under such conditions the contaminated urine would soon reach the pelvis of a weakened kidney under conditions favorable for renal infection. The ureteritis and cystitis interfered with the ability of the vesical portion of the ureter to prevent a reflux of fluid from the bladder into the ureter. On the other hand, the vesical portion of the left ureter is functionally normal as shown in Fig. IX. From a study of the case I should judge that the causation and maintenance of the renal infection was the ureteritis, which gave rise to the ureteral stricture, hence was a means of conveying contaminated urine to the weakened kidney, and that the inability of the ureter to prevent a reflux of urine was secondary and dependent on the ureteritis and would probably disappear as soon as the ureteritis would clear up and thus permit the ureter to become a compressible tube.

Case II.—Mrs. T. M. (Gyn. Nos. 9495, 9705 and 9962). First admitted to this hospital in March, 1902. A diagnosis of double pyonephrosis was made, apparently following childbirth five years before. Tubercle bacilli were never found in the urine; the patient was given tuberculin, but no reaction followed. Cultures taken from each kidney showed colon bacilli. She was treated by rest and frequent irrigations of the pelves of the kidneys through renal catheters. She left the hospital June 3, 1902, improved. She was readmitted at the end of a week, and remained in the hospital a month longer, and during that time both kidneys were irrigated three times a week with a solution of silver nitrate 1-500, followed by sterile water. She was readmitted October 5, 1902, with the same complaint. Apparently, the treatment in the hospital had given her temporary relief only. The kidneys were irrigated as on previous admission until December 22, 1902, when an incision was made into the left kidney and a vesico-vaginal fistula was also formed. This was done because the bladder had become markedly inflamed and it was impossible to catheterize the ureters. A month later the vesico-vaginal opening was enlarged and a suprapubic incision was made in order to give the bladder free drainage. At the end of six months the patient's condition had improved but very little. There was evidently a stricture of both ureters, for the left could be catheterized only with great difficulty and the right not at all. Cultures from the left kidney showed a pure culture of pyocyaneus instead of colon bacillus as at the first admission. On vaginal examination both ureters could be distinctly felt as thickened tender cords. The patient desired to go home, but before closing the vesico-vaginal fistula in order that she might go, I determined to ascertain whether it would be safe to do so. On June 7, 1903, I inserted a catheter, which was connected to a funnel by rubber tubing, into the bladder, and then placed a finger in the vagina so as to close the vesico-vaginal opening. Fluid was now poured into the funnel and thus the bladder was filled until it caused discomfort but no actual pain. The patient stated that she could feel something passing up her ureters into her kidneys which caused pain in both kidneys. The fluid was withdrawn. Three hours later the patient's temperature rose to 102.6°. She had a chill and severe pain in the region of both kidneys. This condition lasted for four days, and gradually subsided. It was very evident that the distention of the bladder caused a reflux into the ureters, thus interfering with the function of the kidneys and at the same time conveying contaminated urine, which gave rise to renal infection. The closure of the vesico-vaginal fistula would give rise to the same condition, for the diseased vesical portions of the ureters were rigid tubes and were unable to prevent a reflux of urine under distention of the bladder. Upon June 26, 1903, I incised the right kidney, making a nephrotomy. Upon July 20, I resected the left ureter and reimplanted it into the bladder by the extraperitoneal route. Upon September 8, 1903, I resected and reimplanted the right ureter through a gridiron incision, extraperitoneally, using a local anæsthetic only, Schleich's solution

and cocain 1 per cent. The cystitis has disappeared and I have catheterized both ureters and the newly implanted ureters were free from stricture. On November 11, 1903, I tested the efficiency of the new ureteral orifices. I repeated the experiment made on June 7, referred to above, using a solution of methylene blue. The patient stated that she could feel the fluid pass into her left kidney but not into her right. The bladder was washed out with sterile water and then a cystoscopic examination was made. Blue fluid could be seen coming from the left ureteral orifice but not from the right one. The left ureter was catheterized and blue fluid was obtained from the pelvis of the left kidney, clearly demonstrating that a reflux had occurred. No ill effects followed this experiment as did the previous one, probably because the ureter was free from stricture and the cystitis had disappeared. The same day I again resected the left ureter and reimplanted it into the bladder using Schleich solution only, as a local anæsthetic. I have been able to implant a diseased and thickened ureter so as to prevent a reflux, on the right side. It remains to be seen if I have accomplished the same result with the left ureter.

In this case the renal infection apparently was primary. This caused the ureteritis and cystitis. A stricture of the ureter occurred which aggravated and maintained the renal infection. The lower portions of the ureters were converted into sinuses, there being nothing to prevent a reflux of urine into the ureter. The reflux of urine also aided in maintaining the renal infection. When a vesico-vaginal fistula was formed this reflux could not occur, hence the kidneys were temporarily relieved but as soon as the fistula was closed, the reflux from the bladder kindled the infection anew.

Warschauer[30] has reported a case whose clinical history is similar to the above. He described the ureteral orifices as two large craters, while in my case they appeared more like two large funnels. He demonstrated a reflux of fluid from the bladder into the ureters by distending the bladder with colored fluid and recovering the latter from the pelvis of the kidney by means of a renal catheter.

It is clear then that a reflux of urine from the bladder into the ureter may occur under diseased conditions and while the condition which gave rise to the reflux is probably the primary cause of the renal infection, nevertheless, the reflux must aid in maintaining not only the local cystitis and ureteritis but also the renal infection itself.

B. Reverse Peristalsis of the Ureters as a Cause of Renal Infection.

Lewin and Goldsmith[31] have seen colored fluids carried from the bladder to the ureter by this method. These observations were made on rabbits and have been referred to. They thought that they had found an explanation for many of the clinical symptoms found in man, and reported a case in which they examined by means of the Nitze cystoscope the bladder of a young man who had gonorrhœa. The bladder was very irritable, and in the fluid with which the bladder was distended could be seen flakes of pus, which while under observation were pushed out by the stream of urine coming from the ureters and then again drawn towards the ureteral orifice as though a reverse peristalsis had occurred and a stream of fluid was passing back into the ureters.

Disse[32] refers to the experiments of Lewin and Goldsmith and explains how a reverse peristalsis on the part of the ureters may convey fluid from the bladder to the kidney. The intra-vesical portion of the ureter is made up of longitudinal muscular fibers. When these contract the ureter is converted into a rigid tube and the ureteral valve is thickened so that intra-vesical pressure cannot force it against the posterior ureteral wall, and thus the bladder contents can enter the ureter and be carried to the kidney by reverse peristalsis.

The function of the ureters is to convey urine from the kidneys to the bladder. The anatomical structure, especially of the vesical portion of the ureter, supports the above view, and contraindicates the reverse. I have never seen reverse peristalsis in dogs, nor have I seen it in human beings. One would expect it to occur in stricture of the lower end of the ureter. In two cases of stricture of the lower end of the ureter, I resected the ureter and reimplanted it in the bladder. The operation was done without a general anæsthetic, Schleich's solution being used. The extraperitoneal route was used and the ureters which were resected were under observation for a long time. In one case (Gyn. No. 10713), the ureter was dilated to a diameter of 1 cm., the walls were very thin and the ureter did not contract once. It was apparently a passive organ. The stricture was of but a few weeks duration, for it was due to necrosis of the ureter following hysterectomy for cancer of the uterus, and giving rise to an uretero-vaginal fistula. The other case (Gyn. No. 9962) was secondary to cystitis of long standing. The walls of the ureter were very thick and the ureter contracted several times during the operation, but I did not see reverse persistalsis take place.

If reverse peristalsis occurs, why is it that in cases of unilateral renal infection, the urine from the sound kidney may be sterile, or in cystitis the urine from both kidneys may also be sterile?

C. Suction of Air into the Ureters when Patients are Examined in Knee-Breast Posture through an Open Cystoscope, as a Cause of Renal Infection.

Kelly[33] states that frequently he has seen bubbles of air emerging from the ureteral orifice and this has been an aid in locating it. He thinks that the air entering the orifice at the temperature of the room, is heated within the ureter to the body temperature and is then forced out of the ureteral orifice in the form of a little bubble. He has frequently observed this under pathological conditions, and calls attention to the fact that because air enters the ureters under some conditions this does not prove in any way that they are not water-tight under physiological conditions.

It is difficult from a study of the anatomy and physiology

of the ureters under all degrees of distention and intravesical tension of the bladder, to see how that this could be a means of carrying infection from the bladder to the kidney under normal conditions.

TREATMENT OF ASCENDING RENAL INFECTION.

The purpose of this paper is to describe the avenues by which infection may travel from the bladder to the kidney, and not the symptomatology and treatment of such conditions. The rational treatment of any condition should be based on a knowledge of the normal and pathological anatomy of the parts concerned, together with the experience gained from clinical observations. As a result of these studies I wish to make a few suggestions, and to emphasize some of the "do's and don'ts" in the treatment of cystitis and renal infection.

Cystitis is a serious disease, not unattended with danger to the life of the patient, and its treatment is difficult. This becomes evident when I state that during the last year, there have been five deaths in the gynecological department of this hospital apparently from ascending renal infection.

Case 1.—(Gyn. No. 9966). Tuberculosis of the bladder and right kidney. Ascending renal infection of the left kidney was apparently caused by the curettage of the bladder. Nephrectomy was done. Renal insufficiency was present, and the patient died. Autopsy.

Case 2.—(Gyn. No. 10432). Cystitis following a radical operation for cancer of the uterus. Ureters were not resected. Retention catheter was used; this apparently caused trauma to the bladder wall, and by an extension of the infection, the ureteral orifice became involved and renal infection occurred. The patient died on the ninth day. Autopsy. See drawing No. VIII.

Case 3.—(Gyn. No. 10468). Post-partum, vesico-vaginal fistula of twenty years duration. The treatment consisted in the examination of the patient under ether and the removal of foul sloughs in vagina and bladder with forceps. A retention catheter was placed in the bladder and the patient was put in a tub with continuous irrigation through the catheter. Patient died suddenly at the end of the fifth day. Autopsy not permitted.

Case 4.—(Gyn. No. 10505). Cystitis following radical operation for cancer of the uterus. Both ureters were resected and implanted in the bladder. A retention catheter was used. The patient died on the seventeenth day. Autopsy. Bilateral renal infection. The cause of renal infection was probably the extension of the inflammatory process to the kidney through the injured ureteral orifices, namely, the recently implanted ureters.

Case 5.—(Gyn. No. 10642). As in No. 3, post-partum vesico-vaginal fistula of fifteen years duration was present. Patient was examined without anæsthesia and with the fingers large sloughs were removed from the vagina and bladder. The patient was put in a tub with continuous irrigation, as was Case No. 3. She died within twenty-four hours with the same symptoms as Case No. 3. An autopsy showed bilateral renal infection, acute and chronic, with stricture of the ureter. In both these cases renal infection was possibly the cause of death.

In the treatment of any condition a diagnosis is most important and this is especially true in conditions where pyuria and hæmaturia exist. Frequently cases are treated for years for cystitis when the primary focus is in the kidney, and the inflammatory condition of the bladder is maintained by the discharging of infected urine into that organ. A case of hæmaturia or pyuria should never be treated until a cystoscopic examination has been made and the source of the trouble determined. The question of catheterizing the ureters in the presence of infection presents itslf. One realizes that the most important accessory etiological factor in the causation of renal infection is something interfering with the function of the kidney, and in cystitis, a stricture of the ureter is probably the most frequent cause. The introduction of organisms into the pelvis of a normal kidney probably will not cause any harm, while the introduction of the same organisms under similar conditions into the pelvis of a kidney whose ureter is strictured is very likely to give rise to renal infection. Hence a ureter should not be catheterized in cases of urinary infection because "its orifice is apparently diseased" unless purulent urine is seen escaping from it. In this respect, after making a cystoscopic examination and the condition of the bladder is known and the probable source of the infection determined, the use of a segregator is a safer and more rational method than catheterizing the ureters in the presence of infection; or the urine may be collected by pressing the end of the cystoscope over the ureteral orifice, as has been described by Dr. Kelly.

Is the hydraulic distention of a contracted bladder justifiable? Young[25] has reported eight cases favorably treated by this method and still uses it. Brown[26] has also reported several cases in which it was used with very satisfactory results at Dr. Kelly's Sanitarium, and it has also been used with satisfactory results in the gynecological department of this hospital. These cases demonstrate the efficiency of the intravesical portion of the ureter and how rare it is that even under diseased conditions of the bladder that fluid may be forced from the bladder into the ureters. This method is very valuable in suitable cases, but would certainly aggravate a renal infection should a reflux be possible. One realizes that when a reflux is possible renal infection probably already exists and is maintained by intra-ureteral pressure and so the reflux helps to maintain it, and that hydraulic distention would only increase the intra-ureteral pressure already present. It would certainly have caused harm in the two cases reported in this article. One can see that this method, while of great service in a certain class of cases, would be harmful in another class; namely, where a reflux was present. Again the question of diagnosis presents itself and if possible the condition of the ureteral orifices should be determined before using this method and should they be functionally diseased, i. e., should the distention of the bladder cause symptoms suggesting a reflux of urine, then it seems to me that the case would be unsuitable for this treatment. The reflux may better be diag-

nosed by distending the bladder with some colored solution and then irrigating the bladder with water. If in making a cystoscopic examination the colored fluid can be seen coming from the ureteral orifice, then a reflux has occurred; this can be confirmed by catheterizing the ureter and obtaining the colored fluid from the pelvis of the kidney as I did in one instance. On the other hand, should the ureteral orifices be functionally normal, the hydraulic distention of the bladder could not injure the kidneys. In cases in which a reflux was present and the bladder was contracted, a nephrotomy could be done, thus better relieving the renal infection and then the distention of the bladder with fluids would probably be beneficial, not only to the bladder but also to the kidney, for its pelvis would be washed out from below.

Curettage of the trigonum of the bladder is attended with danger of so injuring the ureteral orifice that renal infection may take place, and hence it seems to me that it is contraindicated.

What should be done in instances of renal infection secondary to cystitis? For those cases demanding immediate attention, nephrotomy is indicated. On the other hand, when the diagnosis is uncertain and the renal condition does not seem urgent, the most rational method is to relieve the primary focus or cause of the trouble.

In cystitis the renal affection is maintained usually by a stricture caused by the thickened bladder wall squeezing the ureter, or by a ureteritis, or the function of the ureteral orifice may be so interfered with that it is unable to prevent a reflux of the urine from bladder into the ureters. In either instance the increased intra-ureteral pressure maintains the renal infection. Should the stricture be relieved by dilatation of the ureteral orifice? If it is due to a thickened bladder wall, certainly it would be difficult to accomplish this without injuring the ureter; and if it is due to a ureteritis, the same difficulties present themselves. On the other hand cases have been reported which have been successfully treated by this method.

The best surgical treatment for infection in any part of the body is free incision and drainage, together with rest of the part diseased. It seems to me that the most rational treatment for cystitis in women with renal infection is the formation of a vesico-vaginal fistula, which will give free drainage of the bladder and also permit it to rest. In many cases this will probably clear up the cystitis and thus the ureteral stricture may be relieved and the function of the kidney will not be interfered with; and so the renal infection may be terminated without further operative interference. I have followed the bladder conditions in ten cases where the more radical operation for cancer of the uterus had been done. In seven cases a severe cystitis occurred and two of the seven terminated in renal infection and death. In the three cases where the bladder symptoms have not been marked and cystoscopic examination showed a normal-appearing bladder mucosa, an accidental vesico-vaginal fistula was present. While it is not safe to generalize from ten cases, nevertheless, the presence of the vesico-vaginal fistula apparently prevented a cystitis, for cultures from the bladder were taken in two of these three cases and the colon bacillus was found in large numbers. This, it seems to me, emphasizes the importance of this well-known means of treating cystitis, and unless we find some other means of controlling the cystitis following these operations, it would be justifiable to make a vesico-vaginal fistula at the close of the operation, in order to prevent or control the cystitis which is so apt to follow. The retention catheter cannot take its place, for it is likely to become foul and covered with salts and to act as a foreign body in the bladder: and again, one can never tell whether it is doing its work, for it may be draining the bladder only when the bladder is distended.

Should the renal infection persist, a nephrotomy with free drainage of the renal pelvis is next indicated. If the bladder clears up and also the renal infection, but a ureteral stricture persists or the ureteral orifice is so diseased that a reflux of fluid from the bladder takes place, then the ureter should be resected and reimplanted into the bladder. The results of the latter are uncertain, for the ureter may be so extensively diseased that it will be impossible to resect the entire diseased portion, and it will be necessary to implant a diseased ureter into the bladder, which may give rise to a stricture or be unable to prevent a reflux, the very things for the relief of which the operation was undertaken. In some cases permanent drainage of the bladder through a vesico-vaginal fistula or the pelvis of the kidney through a lumbar incision, may be necessary.

CONCLUSIONS.

I. The vesical portion of the ureter changes under the various degrees of dilatation and of intra-vesical tension of the bladder, and in each of these conditions one may find special provision for guarding the lumen of the ureter and thus preventing a reflux of urine from the bladder into the ureter. Under all conditions of the bladder the direction of the current of urine from the kidney to the bladder is a constant factor in the prevention of ascending infection. In addition there are present:

A. In the distended bladder, the very oblique course of the ureter and the long ureteral valve, the lateral walls or labia of the ureteral orifice, and the mucosa of the ureter.

B. In the contracted bladder, the course of the ureter is less oblique, the ureteral valve is shorter and these factors apparently play a less important part in the protection of the ureter, than they do in the distended bladder. On the other hand additional protection is afforded by a puckering of the ureteral orifice; the ureteral labia may come together, and the ureteral mucosa is thrown into folds.

II. The anatomical structure and physiological action of the ureters as well as clinical experience would indicate that the function of the ureters is not only to carry urine from the kidneys to the bladder but also to prevent fluid from passing into the ureters from the bladder, and that under normal conditions it is impossible for the latter to take place. Cases have been reported which contradict this statement. The fact that an occasional case has been reported in which appa-

rently a reflux has occurred, especially when nothing is known of the condition of the ureteral orifice in these instances, cannot be regarded sufficient evidence for supposing that it may occur in all cases.

III. Organisms may be conveyed from the bladder to the kidney through the following channels:

I. The general circulation.

II. The vesico-utero-ovario-renal anastomosis. There is both a venous and an arterial communication between the renal and vesical vessels through the ovarian and uterine vessels.

III. The blood-vessels of the ureter. The renal and vesical vessels may communicate with each other through the free anastomosis of the ureteral vessels.

IV. The lymphatics. The communication between the lymphatics of the bladder and those of the kidney is indirect either through the local glands of the bladder and kidney or through the lymph vessels of the ureter. (Sakata).

V. The lumen of the ureter. This may be as follows:

a. By injuries to the intra-vesical portion of the ureter.

b. By the extension of an inflammatory process from the bladder through the ureteral walls or along the lumen of the ureter. This is probably the most frequent way.

c. By organisms traveling up the ureter, especially when the current of urine from the kidney to the bladder is interfered with by a stricture or something occluding the lumen of the ureter.

d. By a reflux of urine from the bladder into the ureters, which may be due to:

1. Intra-vesical pressure, forcing the urine into the ureter.

2. Reverse peristalsis on the part of the ureter carrying urine from the bladder into the kidneys.

3. By suction of air into the ureters, when patients are examined in the knee-breast posture, through an open cystoscope.

The reflux of urine from the bladder into the ureters may be considered an etiological factor in the causation and maintenance of renal infection only when the intra-vesical portion of the ureter is diseased, thus impairing its function, or when some ureteral abnormality exists.

Two accessory etiological factors of great importance in the causation of renal infection must be considered:

I. An injured kidney, that is, one which presents a lowered *local* resistance. The most frequent cause of this is probably a ureteral stricture due to cystitis or calculus.

II. General ill health of the patient, that is lowered *general* resistance.

When one realizes what an important part both lowered local and lowered general resistance may play in the localization of infection in all parts of the body, and at the same time considers that pathogenic organisms are found in the different organs soon after death and that "persons rarely die of the disease with which they suffer" because a terminal infection intervenes, the question arises, what is the source of this infection? Many investigators have made cultures from the organs of healthy animals and different results have been obtained. These results have been discussed by Adami and Ford, the latter obtaining organisms from the kidneys and other organs of healthy animals in a large percentage of the cases examined. If in healthy persons pathogenic organisms frequently get into the circulating blood and are in part killed in the different fluids and organs of the body, and if one of the functions of the kidney is to remove organisms from the blood which have not been killed before reaching that organ, either by destroying them or excreting them in the urine, we must add another form of renal infection, namely, autogenous infection. Lowered local and general resistance may so interfere with the function and resistance of the organ that it is no longer able to destroy or excrete organisms which under healthy conditions would have been done away with, and renal infection may occur. On the other hand if the above is true, why does not renal infection occur more frequently, and why are not organisms found more often in the urine and blood of healthy individuals?

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Discussion.

Dr. Russell.—Dr. Sampson is to be congratulated on this excellent piece of work and all can readily see the practical bearing it has from the operative standpoint. It is difficult to discuss so broad a subject, but the more one considers it the more will one be impressed with his work. The question of cystitis has always been the *bête noir* of gynæcologists and Dr. Sampson has done a great service in his effort to solve these problems.

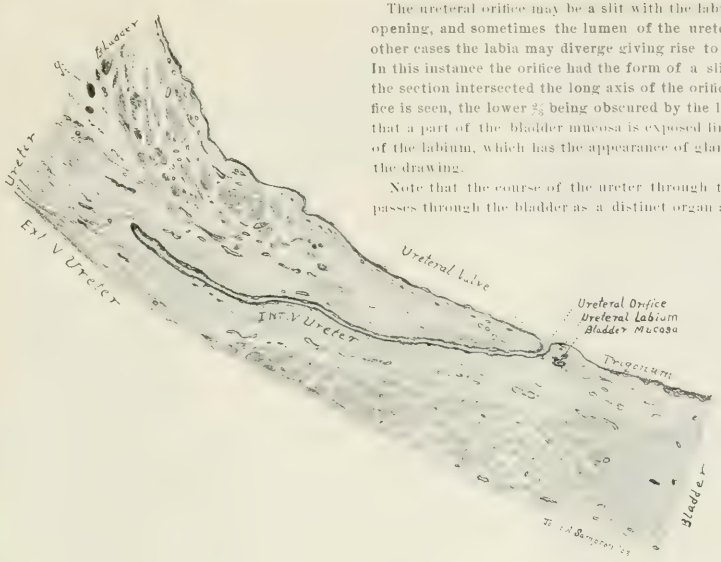
Dr. Young.—I have also been greatly interested in Dr. Sampson's paper and congratulate the author upon his splendid work. The question of a possibility of a reflux from the bladder into the ureters is a subject in which I was particularly interested about 5 years ago. We had at that time on the surgical side a number of troublesome cases of contracture of the bladder, in which the patient had to void urine at very frequent intervals owing to the diminished capacity of the viscus. In several cases the suffering was very great and it was necessary for the patients to wear a rubber receptacle to catch the urine. Something had to be done to relieve their suffering and it occurred to me that by means of hydraulic distention the bladder might be enlarged and the frequency of urination diminished. I began very cautiously, using an elevation of about 5 feet, but I soon found that the patient could stand considerable pressure without danger of rupturing the bladder and in a few days I found that the capacity was distinctly increased.

I remember particularly the case of a man aged 40 who was voiding his urine every 15 minutes night and day and whose bladder held when fully distended only 22 c. c. He was a great sufferer and was unable to attend to his business. On the second day we were able to distend his bladder to 25 c. c., on the third day 30 c. c. and on the fourth day 50 c. c. In two weeks the capacity of his bladder was 110 c. c. and at the end of 8 weeks when he left for home his bladder held 250 c. c. There was at once an improvement both as to interval between urinations and the amount of urine voided at each time. At the end of a week he was voiding 40 c. c. every 30 minutes and of the fourth week 120 c. c. with an interval of one hour and fifty minutes, and when he left for home the average interval between urinations was about 4 hours and the amount voided each time 180 c. c. He continued this treatment at home and at the end of four months his bladder capacity was 370 c. c., and his average interval between 5 and 6 hours. He was then entirely free from pain, had given up the urinal which he previously wore and was able to resume business. I saw this case two years afterwards and found that the capacity of the bladder had been maintained and that his condition was excellent.

In the Johns Hopkins Hospital Bulletin for May, 1898, I was able to report eight cases which had been treated by this method. Since then there have been many others in which the results have been equally remarkable as the case which I have outlined above. At the very beginning of the treatment the possibility of a reflux of the fluid into the ureters was thought of and I would like to quote from the publication referred to on this point.

When this method was first adopted the question arose whether some of the irrigating fluid might not be forced up the ureter, when the bladder became forcibly distended. If such were the case, pus and dangerous micrò-organisms would be carried along, and ascending inflammation and pyonephrosis would certainly result.

FIG. 1.—LONGITUDINAL SECTION OF THE VESICAL PORTION OF THE URETER. × 4. DISTENDED BLADDER.



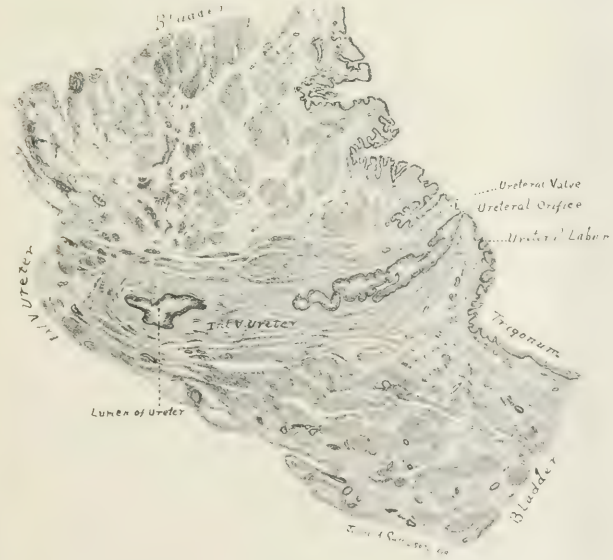
The ureteral orifice may be a slit with the labia close together, or an oval or even almost a round opening, and sometimes the lumen of the ureter extends below the orifice forming a pouch. In other cases the labia may diverge giving rise to an orifice having the form of an inverted V or U. In this instance the orifice had the form of a slit with the labia close together. As can be seen, the section intersected the long axis of the orifice at an angle, so that only the upper ⅓ of the orifice is seen, the lower ⅔ being obscured by the labium which is lateral to it. This labium is so cut that a part of the bladder mucosa is exposed lining the floor of the orifice and the mesial surface of the labium, which has the appearance of gland-like space, and is marked "bladder mucosa" in the drawing.

Note that the course of the ureter through the bladder is very oblique and that it apparently passes through the bladder as a distinct organ and that its mucosa becomes continuous with that of the bladder. Its mucosa is smooth and its lumen is flattened antero-posteriorly. One can see that intravesical pressure would force the ureteral valve against the posterior wall of the ureter and thus close its lumen.

g. is a ganglion

Ext.V. ureter is the extravesical portion, and Int.V. ureter, the intravesical portion of the ureter.

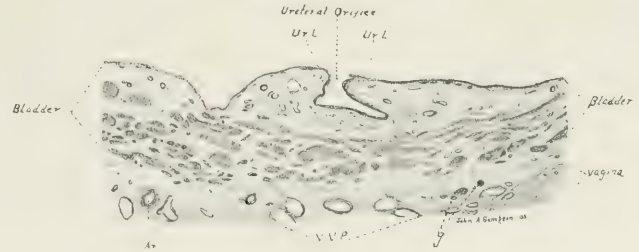
FIG. 2.—LONGITUDINAL SECTION OF THE VESICAL PORTION OF THE URETER. × 4. CONTRACTED BLADDER.



In this instance the orifice had the form of a slit with the labia close together, and the section intersects the long axis of the orifice obliquely so that the ureteral valve is cut and also the lateral labium, and only a small part of the orifice appears, the rest being obscured by the labium, as in Fig. 1. As compared with Fig. 1 the course of the ureter is less oblique, its mucosa is thrown into folds, and the ureteral valve is but the anterior lip of the ureter.

Note the relatively small muscle bundles in Fig. 1 and the larger bundles in Fig. 2 and how the rugae of the contracted bladder are derived from a folding of the bladder mucosa. One can see how the long ureteral valve of the distended bladder arises. In the distension of the bladder the ureteral orifice remains relatively fixed and the fundus distends, thus making its relation to the ureter more oblique and the same time the anterior ureteral lip covered by bladder mucosa is elongated, giving rise to the long valve found in the distended bladder.

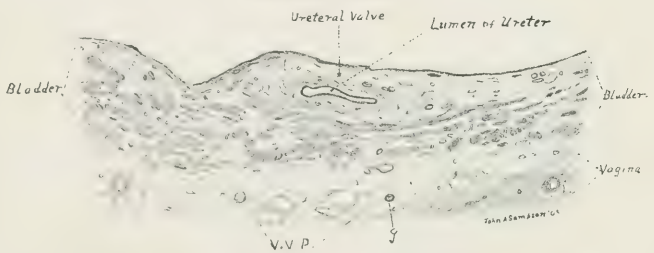
FIG. 3.—TRANSVERSE SECTION THROUGH THE URETERAL ORIFICE. DISTENDED BLADDER, × 4.



In this instance the ureteral orifice had the form of a short oval, appearing almost round, and the lumen of the ureter extended about 1.5 to 2 mm. below the orifice forming a small pouch. The ureteral orifice is practically a portion of the bladder mucosa and subjected to the same changes as the latter. A few of the longitudinal muscle bundles of the ureter can be seen cut transversely. The orifice has been cut a little obliquely, giving rise to a short ureteral labium on one side and a longer one on the other. These labia are but the lateral walls of the ureter on either side of the orifice, and undoubtedly act as a protection to the latter.

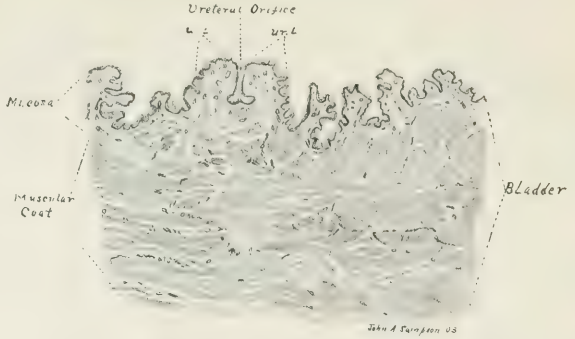
Ar. artery. g. ganglia. V.V.P. vesico-vaginal plexus of veins, which frequently give rise to troublesome bleeding in separating the bladder from the cervix and vagina in hysterectomy for carcinoma cervicis uteri.

FIG. 5. TRANSVERSE SECTION THROUGH THE VESICAL PORTION OF THE URETER, TAKEN JUST ABOVE THE URETERAL ORIFICE, × 4. DISTENDED BLADDER.



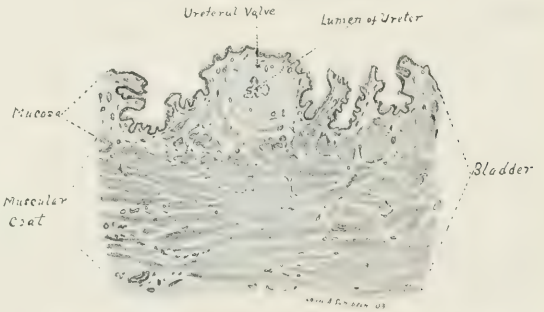
From same specimen as Fig. 3, and about 2 mm. above the latter. The distension of the bladder has converted the lumen of the ureter into a slit. The ureteral valve is well shown as the anterior wall of the ureter covered by the bladder mucosa, and one can see how that intravesical pressure would close the lumen of the ureter.

FIG. 4.—TRANSVERSE SECTION THROUGH THE URETERAL ORIFICE. CONTRACTED BLADDER, × 4.



In this instance the ureteral orifice had the form of a slit with the labia close together. One sees that the ureteral orifice is practically a portion of the bladder mucosa and subject to the same changes as the latter. The longitudinal muscle bundles of the ureter can be seen cut transversely and give form to the latter and cause it to stand out from the bladder mucosa. The ureteral labia are distinct. Compare Figs. 3 and 4 and note the effect not only on the bladder wall and bladder mucosa, but also on the ureteral orifice, in dilatation and contraction of the bladder.

FIG. 6.—TRANSVERSE SECTION THROUGH THE VESICAL PORTION OF THE URETER, TAKEN JUST ABOVE THE URETERAL ORIFICE, × 4. CONTRACTED BLADDER.



From same specimen as Fig. 4 and about 1.5 mm. above the latter. Compare Figs. 5 and 6 and note the effect of dilatation and contraction of the bladder on the ureter. In this instance the lumen of the ureter is star-shaped and its mucosa is thrown into folds, while in the latter it is a transverse slit and its mucosa is smooth.

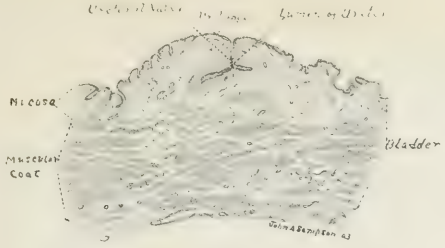


FIG. 7. TRANSVERSE SECTION THROUGH THE URETERAL ORIFICE AT THE TIP OF THE URETERAL VALVE, × 4. PARTIALLY CONTRACTED BLADDER, WITH INTRAVESICAL PRESSURE.

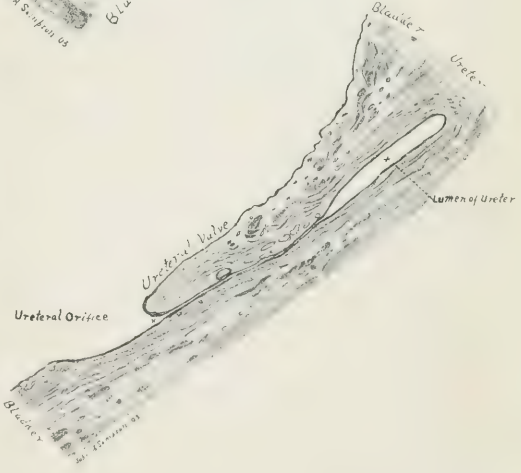
A partially contracted bladder was placed in 10% formalin for 24 hours, and at the end of that time formalin was forced into the bladder through the urethra and the latter was clamped. The orifice had the form of a slit and one can see how the intravesical pressure has flattened the rugae of the bladder and folded in the ureteral labia and at the same time forced the tip of the ureteral valve against the posterior wall of the ureter, thus occluding its lumen. Compare with Figs. 3 and 4.

FIG. 8. LONGITUDINAL SECTION OF THE VESICAL PORTION OF THE URETER, × 4, FROM A PATIENT DYING OF UNILATERAL ASCENDING RENAL INFECTION. GYN. NO. 10432. URETERAL ORIFICE OF INFECTED KIDNEY.



Distended Bladder. Orifice oval, long axis cut obliquely so that upper ¾ of the orifice is seen, the lower ¼ being obscured by a portion of the lateral labium. In this instance post-operative cystitis occurred and one can see how it invaded the bladder wall and by direct extension (A, B, C, D) the ureter became involved. Ar. is an artefact causing an apparent separation of the ureter from the bladder. The entire vesical portion of the ureter became involved and it was converted into a rigid sinus, thus permitting a reflux of urine from the bladder, so that pressure over the bladder forced the bladder contents through the ureter into the pelvis of the kidney.

FIG. 9. LONGITUDINAL SECTION OF THE VESICAL PORTION OF THE URETER, × 4, FROM A PATIENT DYING WITH UNILATERAL ASCENDING RENAL INFECTION. GYN. NO. 10432. URETERAL ORIFICE OF NORMAL KIDNEY.



Orifice had the form of an inverted U and its long axis has been bisected so that the floor of the orifice can be seen for its entire length.

Compare with Fig. 8 and note that the ureteral valve is functionally normal. When pressure was made over the bladder a reflux was prevented and the bladder contents could not be forced into the pelvis of the kidney on this side.

The valve-like arrangement of the orifice of the ureter produced by its oblique course for 1¼ inches in the bladder wall would seem to be a special provision of nature to prevent the backward flow of the fluids from the bladder into the ureters.

In order to determine whether fluid, under considerable hydraulic pressure, would be forced into the ureters I experimented on a cadaver. After the intestines were removed the ureters were dissected out and cut across within a few inches of the bladder. A very strong solution of methylene blue was prepared and forced into the bladder through the urethra from an elevation of fourteen feet.

The bladder rapidly distended, but no fluid ran out of the cut ureters, although the distention was kept up until 1700 cc. (nearly two quarts) were forced in, and the walls became so thin that the blue solution shone through, and the threatening aspect of the huge bladder caused most of the bystanders to leave the room.

When the bladder was incised the mucous membrane was found deeply stained blue, but the stain did not extend 1-32 of an inch into the ureteral orifices.

In another cadaver, with a large sacculated bladder and double hydro-ureters, I found it impossible to force fluid from the bladder into the ureters.

To further test the matter I made the following observations upon a dog, April 4:

A small male dog received 1 gr. morphia hypodermically. Very deep colored solution of gentian violet prepared. By the hydraulic pressure of 11 feet (above the dog) the fluid was forced into the bladder without a catheter until the greatly distended bladder could be seen through the abdomen.

Abdomen then cleaned, dog etherized, laparotomy performed. Bladder greatly dilated, and dark purple in color from fluid within, intestines pushed aside, ureter located. It contained perfectly clear urine and not a particle of the violet stain. Kidney exposed, no stain present. Although the ureter was watched for sometime, no vermicular movement was noticed until the fluid was evacuated from the bladder, when it was distinctly to be seen. Bladder had remained distended for fully 10 minutes. On another dog under ether we exposed the ureter after laparotomy, and watched it carefully while various amounts of fluid were forced into bladder. There was never any passing of the fluid into the ureter. No reverse peristalsis was made out.

These operations seem to show conclusively that fluid cannot be forced up the ureters from the bladder in the dog and in man, and they have been borne out by clinical evidence, for in none of the cases has there been any evidence of ascending infection, although the bladders contained many virulent organisms, some streptococci.

I am glad to see that the results of Dr. Sampson's researches are completely in accordance with mine. I am particularly pleased by this confirmation because several European authors, notably Lewin and Goldschmidt and Courtade and Guyon have taken the opposite view as the result of several, to my mind, entirely inconclusive expriments upon rabbits, which I have also referred to in my paper.

My clinical experiments in the past 5 years have shown conclusively that the reflux of fluid does not occur even on very forced distention of the bladder and that the method may be used with safety.

The cases which Dr. Sampson has cited in which the very greatly diseased ureters have presented patent orifices into which fluid would at once flow when forced into the bladder are certainly very exceptional ones. I have seen several such specimens in the pathological laboratories here and in Paris but in all instances there was extensive disease of the pelvis of the kidney and already a free communication between the septic urine of the bladder and of the kidney, so that in cases of this sort I feel sure the reflux of a small amount of antiseptic solution from the bladder into the ureter would not have done any harm, but possibly might have been beneficial. It would seem to furnish an easy method of treating the ureter and pelvis in such conditions and do away with the necessity of using the ureteral catheter as has been done by Dr. Kelly and others.

The suggestion of using the cystoscope to determine the condition of the ureteral orifice before beginning the treatment by hydraulic dilatation is a good one, but unfortunately in cases of marked contracture of the bladder a great difficulty is experienced in making such an examination and it is not always practicable; and my experience has taught me that it is not often necessary.

I have a man now in my charge who has been a very great sufferer from vesical contracture and the great relief and benefit which he has received after two weeks' treatment make me wonder that the method which I described 5 years ago has not been more generally adopted, especially as cases of this sort are unquestionably fairly common.

I wish to thank Dr. Sampson for his splendid report.

DR. HUNNER.—I wish to add my congratulations to Dr. Sampson upon this admirable piece of work which points out so many things of value to the surgeon. Some days ago I operated upon a vesico-vaginal fistula case in a young girl where the fistula had been made some months before to relieve a bladder ulceration. On the 6th day after operation the patient's temperature went up to 102 and she felt rather miserable. There was tenderness in the line of her only ureter and we cannot help thinking, in view of this work of Dr. Sampson's that the bladder had become overfilled and that some of the urine escaped back into the kidney. She had but very small bladder capacity and had been instructed to void as frequently as she could until the fistula wound was healed but possibly this was not done during the night.

I have another patient that I am watching who gives a history indicating double renal infection at the time of pregnancy last year with a resultant stricture of the ureter. I can pass the catheter 8 cm. on the obstructed side. Since last May she has had attacks of renal colic on that side and the interesting point is that these attacks always come on late in the night, and the question arises again whether that is not because the bladder becomes over-distended during sleep and a reflux takes place.

DR. SAMPSON.—The object of this paper is certainly not to condemn a procedure which has proven so useful in the treatment of cystitis. In considering the advisability of resecting the ureters in hysterectomy for carcinoma cervicis uteri, the question arose, would a reflux of urine from the bladder into the ureters occur after such an operation. In order to answer this question it became necessary to study the vesical portion of the ureter and the conditions under which a reflux was

possible. During this last year there have been two cases in the gynecological department of this hospital in which a reflux of urine from the bladder into the ureters was demonstrated. In both cases a ureteritis was present and this interfered with the function of the vesical portion of the ureters. Dr. Young called attention to the fact that in autopsy subjects, it is impossible to bring about this reflux. I realized that, and in one instance, I introduced a canula, connected by rubber tubing with a funnel, into a bladder just removed at autopsy. Water was poured into the funnel. The bladder became greatly distended but the water did not escape from the ureters, which had been cut off close to the bladder. I converted the vesical portion of one ureter into a rigid tube by first introducing an ureteral catheter into its lumen and then applying formalin to this portion of the ureter and bladder. The walls of the vesical portion of the ureter became so hardened by the application of formalin that after removing the catheter and squeezing the bladder, fluid escaped from the ureter.

I wish to state again that I do not wish to condemn a method of treatment which has proven so satisfactory, but I want to call attention to the fact that under certain conditions a reflux from the bladder into the ureters is possible, and those who use hydraulic distention should bear this in mind.

A MORPHOLOGICAL STUDY OF THE BLOOD OF CERTAIN FISHES AND BIRDS, WITH SPECIAL REFERENCE TO THE LEUCOCYTES OF BIRDS.[1]

(INCLUDING A NOTE ON THE OCCURRENCE OF FILARIÆ IN THE BLOOD OF TWO BIRDS AND TWO PORCUPINES.)

By Ernest K. Cullen, *University of Toronto.*

The present paper is the outcome of a comparative study of the blood of different types of vertebrates, which was carried on during the summer of 1902 in Chester, Nova Scotia, and continued during the past winter in Toronto. It is based upon the examination of some fifty different species, of which twenty-nine were birds. While the paper deals primarily with the leucocytes of birds, certain observations have been incorporated on the red cells of fishes, which appeared to be worthy of note.

The literature dealing with the subject under consideration, especially from the standpoint of color analysis, is rather meagre. Aside from casual references in the writings of Ehrlich, Corin, Tamassia, Ilberg and Pappenheim, there are only the papers of Niegolewsky,[1] Hirschfeld,[2] Rawitz,[3] Grünberg[4] and Meinertz[5] to be considered. Altogether 33 species are dealt with, and so far as birds are concerned I was able to find but two systematic examinations, viz.: those of the blood of the chicken and of the sparrow, by Grünberg The paper of Meinertz, which has to do with the blood of several fishes, one reptile and a few invertebrates, appeared when my own studies were already in progress. Rawitz devotes his attention to six fishes; Grünberg deals with three amphibia and two reptiles, while Hirschfeld's paper takes up the leucocytes of mammals (11 in all). Unfortunately Niegolewsky's dissertation was lost, and I have been unable to secure another copy. My recollection is, that he had six or seven animals in all, representing the five great classes of vertebrates.

It is not my purpose to enter upon a detailed analysis of the findings of those who have occupied themselves with this subject, but I may say that their results are not altogether in accord. The question, for example, whether or not the neutrophilic granulation is peculiar to man and the anthropoid apes still remains open. Niegolewsky finds neutrophilic granules in every species examined; Ilberg states that the ε-granulation occurs in calves, the ox, sheep and rabbit; Tamassia also finds it in the ox, sheep and rabbit, and besides in the pig and cat, while Professor Ehrlich, only last summer, writes us "neutrophile Zellen finden sich nur beim Mensch und Affe-andere Angaben sind unrichtig." Such differences in opinion suggest of course that the technique employed by the various investigators has not been uniform, and possibly not adequate. In order to obviate errors that might be referable to such causes I have proceeded as follows: From every animal at least six blood-films were prepared and one of each stained with eosinate of methylene blue, Ehrlich's triacid, the eosin-aurantia-nigrosin mixture, methylene blue, and Pappenheim's methyl green and pyronin. For routine work I found the eosinate most useful, and preferable to the triacid for various reasons, not the least important being the fact that the air-dried blood-films can be stained at once without further fixation. Moreover, it stains the Mast-cell granules, which remain unstained with the triacid; it brings out the so-called granular degeneration of the reds; it gives very satisfactory pictures of nuclear structure, of polychromatophilia, etc., advantages which all depend upon the presence of the methylene blue as the basic component of the dye, as compared with the methyl green in the triacid. Objections have been raised here and there to its use on the score that the results obtained are not constant. I have satisfied myself, however, that providing the dye is carefully prepared this is not the case, and that uniformly satisfactory pictures can be obtained. Conclusions can, however, not be drawn as regards the affinity of certain granules for acid and neutral dyes from its use alone, no more than from that of the triacid, for the reason that not every granule which is stained red or violet is necessarily oxyphilic or neutrophilic. Oxyphilia was only regarded as demonstrated when the granules in question could be stained with the eosin-aurantia-nigrosin mixture, while with basic dyes they remained colorless; neutrophilia was similarly assumed to exist, when oxyphilia and basophilia both could be excluded, while with the eosinate and the triacid the granulations in question could be stained.

[1] Presented before the meeting of the Toronto Pathological Society, March 28, 1903.

Pappenheim's methyl green and pyronin stain was found very advantageous in distinguishing non-granular leucocytes from certain formations in the blood of those animals, in which the erythrocytes are normally nucleated. To these structures I shall revert later on, but I may say at this place that, in the beginning of my studies especially, they caused much trouble in deciding their true nature. As regards the method of preparation of the blood-films I usually proceeded in such a manner that a number of smears were made upon slides and others upon cover-glasses. The latter are more conveniently fixed by heat, when it is desirable, as in the case of the eosin-aurantia-nigrosin mixture to heat for at least one hour. The use of slides, on the other hand, is much more convenient, and with care no more damage is done to the cellular elements than with the cover-glass method.

In this connection I should like to speak of certain observations which were made upon the blood of two representatives of the cartilaginous fishes, viz., the common dogfish and the skate. It was noted that in the blood of both animals an extensive hæmocytolysis was taking place, and at first I was inclined to ascribe the phenomenon to the somewhat unfavorable conditions under which the dogfish specimens had been prepared, viz., in the fog, where it was readily conceivable that even in the brief period during which the films were exposed to the damp atmosphere, a dissolution of the hæmogloben with coincident changes in the nucleus and stroma, might possibly have taken place. Later, however, the same changes were observed in the blood of the skate, which was obtained under much more favorable surroundings, in the laboratory and on a day on which there was no fog whatever. At the time when these observations were made I was not aware that Rawitz had already described the phenomenon in the case of the dogfish, and had also noted it in the blood of Sargus vulgaris, where, however, the erythrocytolysis was not so extensive. That we were dealing with an actual dissolution of the red cells was, of course, very manifest, for it was easily possible to demonstrate all sorts of transition stages from the normal red cell to mere nuclear shadows occurring free in the blood with complete dissolution of the protoplasm and loss of staining power. From the fact that these changes can be observed in every specimen of blood, that they affect a very large number of cells and that they can be demonstrated to a certain extent also in the wet preparations, Rawitz assumes that in the circulating blood of the dogfish an actual destruction of red cells occurs. Our own observations have also led us to believe that an actual erythrocytolysis may occur in the circulating blood of the animal, but we are not prepared to accept Rawitz's conclusions as to the extent of the process. It seems difficult to understand on what basis Rawitz concludes that erythrocytolysis in the circulating blood is proven by the extensive degeneration of the blood as we see it in stained specimens. It seems much more plausible that the numerous degeneration forms which are here seen are produced *post mortem*, and that the unusual extent of the cytolysis is merely an index of an extreme vulnerability of the cells. The examination of wet specimens by the ordinary method does not help us to disprove the possible occurrence of a certain degree of erythrocytolysis in the circulating blood, and as a matter of fact we do not wish to deny its occurrence. As I have said we are merely not prepared to accept its occurrence to that degree to which Rawitz inclines. It is quite natural to suppose that the oldest cells may already break down in the circulation, and we have been able to convince ourselves that such a destruction actually does go on under normal conditions in the blood of all vertebrates. In the blood of birds, for example, in which the red cells are remarkably resistent to mechanical injury, it is always possible to demonstrate a certain number of erythrocytes which are undergoing dissolution, and to make out all possible intermediary forms between the mature normocyte and its shadow, in which the stroma is practically all gone and the nucleus remains as a faintly staining hydropic mass. Even in the blood of the mammal we meet with similar conditions, though the process can here not be followed so readily owing to the absence of a nucleus.

While studying the various degenerative appearances in the blood of the dogfish and the skate, an observation was incidentally made which seems to be worthy of note, and which has not been previously described. This is the occurrence of a most extensive grade of a degenerative process that appears to be closely analogous to the basophilic granular degeneration of the blood of man. It affects the protoplasm *per se*, although a granular destruction of the nucleus very frequently occurs coincidently. A connection between the two, however, does not exist in the sense that the basophilic granules of the protoplasm are derived from the nucleus. The various appearances which are seen under the microscope certainly exclude such a possibility. That the process is here a degenerative process and closely associated with the loss of hæmoglobin, is quite clear. In other representatives of the lower vertebrates, viz., in those having oval and nucleated red cells, nothing similar was seen, but it is interesting to note that an analogous process apparently takes place in the blood of frogs that have been poisoned by lead.[6] This observation seems to lend additional support to the view which has been expressed by Dr. Simon, that the so-called granular degeneration of the red cells of man is referable to changes in the stroma.

That Rawitz did not observe the change in question is no doubt owing to the fact that he confined his studies to preparations that had been stained with eosin-hæmatein, the Ehrlich-Biondi mixtures, the triacid and the eosin-aurantia-nigrosin mixture, with none of which the change can be demonstrated in the blood of man either. In our case it might possibly be urged that the phenomenon was artificially produced during the process of fixation by heat. This objection, however, is not valid, as the process could always be demonstrated in preparations that had been stained with eosinate, and in which heat had accordingly not been employed at all.

In his account of the red cells of the dogfish Rawitz describes two principal types, viz., an oval form, provided with

a nucleus which is likewise oval and intensely basophilic, and in which aside from numerous deeply staining granules there is no evidence of any nuclear structure. The second form is round; the nucleus is likewise round, much larger than in the first instance and shows a distinct reticulum; it is less deeply stained, but shows here and there somewhat more markedly basophilic granules. Rawitz pictures these cells as also various transition forms between the two and thinks that the second type represents the first phase in the degeneration of the oval form. We have likewise noted these two types and the transition forms between the two, but we cannot possibly regard the round type as a degeneration form of the oval. On the contrary we regard the round cell as the juvenile form of the oval cell, and we cannot understand how Rawitz could possibly arrive at any other conclusion. The relation between the nuclei is here exactly the same as that which we observe in the case of young and old normoblasts. On the one hand we have a large nucleus, the chromatin of which is arranged in a radiary manner, and is relatively small in amount in comparison to the amount of achromatic substance. At the same time, however, the chromatin has a pronounced affinity for basic dyes and stains well. On the other hand we have the mature nucleus, which is markedly pyknotic, and in which details of structure are only imperfectly to be discerned or absent altogether; it is markedly smaller than in the first type and quite deficient in nuclear juice. But aside from the character of the nucleus there is still further evidence to show that the large round cell is a young active cell and not a degeneration form, and that is the fact that the round forms are quite constantly polychromatic. In this respect also this type closely resembles the young normoblast, as we see it in fœtal blood especially. A degenerating cell, viz., one that is undergoing cytolysis, in our experience, never presents evidence of polychromasia, and as a matter of fact those cells in the blood of the dogfish and the skate which do undergo cytolytic changes, always present an oxyphilic protoplasm, that stains orthochromatically. The behavior of the nucleus, moreover, is quite characteristic in such cells; it shows no structure whatever, no filaments and granules as Rawitz pictures; it stains uniformly and homogeneously and there is no portion which is deeply stained; in the eosinate preparations it appears a light sky-blue. During the process of degeneration the protoplasm then disappears, and the nucleus swells very markedly and finally lies free in the blood as a large, pale blue shadow.

As I have said before, we do not believe that the degree of erythrocytolysis, such as we see it in the stained preparations, represents what actually occurs in the circulating blood, but we are prepared to admit that such a process does occur nevertheless, and is possibly more extensive in the dogfish and the skate than in other animals. I say "in other animals" because we have evidence to show, that cytolytic phenomena do occur in the blood of the higher vertebrates as well. We have noted it in amphibia, in birds and in reptiles. In mammals the study of the problem is more difficult, owing to the non-nucleated condition of the red cells, but here also cytolysis seems to occur under normal conditions.

Rawitz has pointed out in his paper that the apparent existence of two forms of red cells, the oval and the round forms, has previously not been noted in the blood of any vertebrates. Bizzozero, however, has shown in 1880 already that in birds the youngest red cells in the bone-marrow are round cells, and as we have ascertained, even in the circulating blood it is not at all uncommon to find such round cells. However, they are never numerous. But we do meet with large numbers of transition forms between the round cell and the mature oval cell with pyknotic nucleus. The youngest cells can always be readily recognized from their wider meshed, more juicy nucleus, and the fact that they are all more or less markedly polychromatic.

To pass on now to a consideration of the leucocytes in birds, I have examined in all 29 species. They comprise the stormy petrel, drumbird, greybird, chicken, crow, seagull, crane, snipe, spider-bird, blackbird, kingfisher, loon, woodpecker, goose, turkey, duck, grebe, mur, cockatoo, jackdaw, English pheasant, Chinese goose, guinea hen, sandhill crane, pigeon, canary, blue jay, carrion jay, and the so-called old squaw (squam-duck).

Generally speaking the blood of these various birds contains at least four different forms of leucocytes, which in their general morphological habitus and tinctorial properties correspond to the small mononuclear leucocytes, the large mononuclear leucocytes, the eosinophilic leucocytes and the Mast-cells of man. Of these various forms the small mononuclear type most closely resembles the corresponding form in man. The nucleus almost fills the entire cell and is surrounded by a very narrow zone of non-granular protoplasm; both are markedly basophilic, but the protoplasm more so than the nucleus. In well-preserved cells the protoplasm appears as a heavy line surrounding the nucleus, but very often the outline is broken and the impression gained, as though some of the protoplasm had been lost. The size of these cells is rather smaller than in man, but fairly constant in the different types examined, varying between 5.2-5.7 μ. The percentage number, on the other hand, is exceedingly variable not only in the series as a whole, but also in individual animals of the same species. We found the lowest value in the cockatoo, 14.35 per cent, and the highest in the stormy petrel, 91.98 per cent. As a general rule the number in our series varied between 40 and 50 per cent. To illustrate the individual variation I may mention the figures which were obtained in two different turkeys, viz., 40.46 per cent and 68.5 per cent, respectively. A similar lack of constancy seems to occur in all animals including man, though it is here possibly not so great.

The number of the large mononuclear elements is more constant, and in our series did not exceed 13.2 per cent; as a rule we find from 1 to 9 per cent, which practically corresponds to what we see in man. They are smaller, however, than the human form, measuring only from 6.7 to 9.3 μ in diameter. The nucleus is either round or oval or it is some-

what invaginated, so that forms are encountered which quite closely resemble the human transition forms, excepting for their size. These transition forms no doubt merely represent a more mature stage in the development of the karyospheric type, and should not be regarded as transition forms leading on to a different, granular variety, as Ehrlich held in the case of the corresponding form in man. That this transition actually does not occur has been shown by Pappenheim, and we have no reason to think that in birds conditions should be different. We have at no time seen any cells which suggested any possible connection between the large mononuclear leucocytes and the eosinophilic variety or the Mast-cells. Neutrophilic leucocytes, I may mention here, do not occur in birds. As regards the staining properties of the large mononuclear leucocytes, we find that both the nucleus and protoplasm possess an affinity for basic dyes, but unlike the small mononuclear elements the protoplasm is here not more markedly basophilic than the nucleus, so that both structures stain about with equal but not very marked intensity. The protoplasm, as in the human form, is more extensively developed, and here presents evidence of a fine granulation, but as yet we have not been able to convince ourselves that these appearances actually represent true granules. They may be due to the existence of a cytoreticulum and represent nodal points.

The most interesting leucocyte in the blood of birds is the eosinophilic cell, of which we can distinguish two varieties, viz., one in which the eosinophilic material occurs in the form of granules, while in the second variety it is represented by peculiar little spindle-shaped bodies which appear in a measure to be characteristic of the blood of birds and certain reptiles. They are truly oxyphilic, and as shown by their behavior toward the eosin-aurantia-nigrosin mixture, this oxyphilia is of the first order, viz., they stain with the eosin component. These peculiar formations, which vary considerably in size in the different birds, were first discovered by Bizzozero and Torre in 1880,[7] in the blood and bone-marrow of the chicken and have since repeatedly attracted attention. In the case of those birds in which these formations are especially large, each little spindle presents a tiny little dot in its interior, which is colorless. As to the nature and origin of these spindles very little is known that is definite. They are certainly not artefacts, for they can be seen in fresh blood, as well as in dried specimens. Dr. Simon is of the opinion that they may be derived from the second variety, in which granules take the place of the spindles; that they are crystalloids and analogous to similar formations that have been encountered in certain tissues in man, and notably in the epithelial cells of the seminal tubules.[8] He thinks that they result from the granules through loss of water, and as a matter of fact it is possible to reconvert the crystalloids into granules in the wet preparation by adding a droplet of a dilute solution of eosin from the side of the cover-glass. Dr. Simon has also noted that in certain preparations in which the eosinophilic material is present in one dense, apparently undifferentiated mass, the crystalloids separate out upon the application of heat.

The eosinophilic granules proper, which we find in birds, are like the crystalloids true oxyphilic granules, viz., they cannot be stained with either neutral or basic dyes; but their degree of oxyphilia is not as intense as in the case of the crystalloids, so that they commonly appear less deeply stained. The cell bodies of both types are not as large as a rule as in the human being; usually they measure from 6.5 to 7.8 μ in diameter. The nucleus is mostly bilobed, the two lobes being joined in well-preserved cells by a narrow connecting bond, so that Bizzozero not inaptly speaks of a spectacle-shaped nucleus. Mononuclear forms are, however, also met with and probably represent an earlier stage in the development of the polymorphonuclear variety. Such young cells, so far as our own examinations go, are always granular, and the individual granules, to judge from their color at least, at first sight make the impression of being neutrophilic. However, they are really eosinophilic, and it can be shown that the purplish-violet tint which is obtained with the eosinate, is due to the fact that the protoplasm is basophilic and forms a thin layer about each eosinophilic granule. They accordingly are quite analogous to the youngest forms of the eosinophilic myelocytes that we see in man. These cells are not commonly met with and have heretofore not been described in the circulating blood of birds. Meinertz, however, describes similar cells in Emys lutaria (a small turtle). He states that they stain with neutral and acid mixtures—a bright violet-red with the triacid, and eosin color with the eosin-aurantia-nigrosin mixture. We found similar cells also in a little green snake.

The number of the eosinophilic cells appears to vary inversely to that of the small mononuclear leucocytes. In some animals they are not numerous, as in the stormy petrel, and in the greybird, where the number of leucocytes in general is very small, I failed to find any cells of this order; the few leucocytes that were encountered were indeed all small mononuclear non-granular elements. The largest percentages were found in the cockatoo (80.14 per cent), in a loon (71.04 per cent), a Chinese goose (43.81 per cent), the English jackdaw (42.33 per cent), and in a canary (50.29 per cent); in the remaining birds the percentage varied between 10 and 35 per cent. In most specimens the crystalloid type prevailed and only in a few the granular variety was in excess; this was the case with the guinea hen, in which the granular type represented 38.79 per cent of all leucocytes, while the crystalloid variety was merely noted as present. In the kingfisher I found 10.75 per cent of granular forms as contrasted with 3.76 per cent of the other variety.

The fourth type of leucocyte in birds is represented by a cell which manifestly corresponds to the Mast-cell of man. The nucleus is usually round or slightly polymorphous; more rarely several distinct lobes can be made out. It is concentrically located and often takes the basic dye rather better than is the rule in man. The nucleus is large and surrounded by a relatively small amount of protoplasm, which appears to possess no special affinity for any dye. It is usually altogether colorless. The granules may vary much in number and size; they are absolutely basophilic, stain deeply and metachromat-

ically. Quite curious is the markedly shaggy outline which some of these cells exhibit; on careful focusing it is then often possible to make out tiny little protoplasmic filaments to the free ends of which little granules appear to be attached. Very manifestly these granules are set free and we find thus in the case of the Mast-cells at any rate evidence of a process which is quite analogous to the formation of the blood-dust in man, in the sense that the granular material which is elaborated in the cell body is secreted to the outside. The relative number of Mast-cells which we find in birds is quite variable. In a few animals, indeed, I was unable to demonstrate any; but as in the same species the total number of leucocytes was very small, we are not prepared to state that they were really absent. The largest numbers were counted in the blackbird and the Chinese goose, with 23.8 and 17.7 per cent, respectively; next in order came the jackdaw with 13.75 per cent and the kingfisher with 11.3 per cent. In the remaining birds the percentage varied between 0.6 and 8.5.

The size of the Mast-cells is quite variable. We have encountered some in which the diameter did not exceed 4 μ, while in others it was fully 12 μ and even larger.

Neutrophilic leucocytes, I may repeat once more, apparently do not occur in the blood of birds. The absence of such material and the presence of the relatively large percentage of eosinophiles of course is very interesting from the standpoint of the pathologist, bearing in mind the behavior of neutrophilic and eosinophilic leucocytes in the blood of man to various chemotactic stimuli, those which are positively chemotactic for the neutrophilic elements being negatively chemotactic for the eosinophiles. A number of avenues for research and speculation suggest themselves in this connection into which, however, I can scarcely enter at this time.

Before concluding I wish to refer briefly to an incidental observation which was made in the course of our studies, viz., the occasional presence in the blood of some of the animals that were examined of embryonic filariæ. They were found in the blood of a blackbird, a grebe (species of duck) and a porcupine. These observations seem to me of interest, as they illustrate the extensive geographical distribution of the parasite in question. Observations on the presence of filariæ so far north have hitherto, I believe, only been made by J. H. Elliott,[9] who has published a brief note on the occurrence of a filaria in the crow, and by Dr. W. G. MacCallum. In answer to a letter of inquiry by Dr. Simon, Dr. MacCallum writes that he has seen filariæ in great numbers in the blood of crows, as also in several other birds. In our blackbird and grebe they were not very numerous, but in the porcupine Dr. Simon counted over 2100 to one slide, and it is interesting to note that coincidently there were certain blood changes denoting the existence of an anæmia. There were present numbers of nucleated red cells, mostly normoblasts, but also a few megaloblasts; and at the same time there existed a light grade of granular degeneration and of polychromatophilia of the red cells. From a study of the leucocytes it was impossible to state whether a disturbance of the usual percentages existed, as we have no counts from a normal animal for control. A description of the filaria of the porcupine, which apparently represents a new species, will appear at another place.

In conclusion, I wish to express my indebtedness to Dr. Simon, of Baltimore, for his assistance and guidance in the above investigations; to Professor MacKenzie, of Toronto University, and to Messrs. Lamb and Carter, of the Toronto Zoological Gardens, for a number of specimens of birds' blood.

Note.—Since writing the above, I learn from Dr. Simon that he has found filariæ in large numbers in a second porcupine.

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MEMORIAL TO MAJOR WALTER REED, SURGEON, U. S. A.

On the 15th of August a meeting was held in Bar Harbor of friends of the late Major Reed, M. D., U. S. A., to whom in a large degree is due the discovery of the mode by which yellow fever has been spread and the consequent suppression of that dire disease. Representative men were present from different parts of the country and letters were received from various members of committees already appointed to promote the collection of a memorial fund in grateful commemoration of Dr. Reed's services. Important suggestions were presented from President Eliot, Dr. W. W. Keen, Prof. J. W. Mallet and others. Dr. Daniel C. Gilman, chairman of a committee appointed by the American Association for the Advancement of Science, presided, and Dr. Stewart Paton acted as secretary. Among those who took part in the conference were Dr. W. H. Welch, of Baltimore; Dr. Janeway, of New York; Dr. Abbott, of Philadelphia; Dr. Herter, of New

York; Dr. Barker, of Chicago; Dr. Putnam, of Buffalo; Dr. Fremont Smith, of Bar Harbor, and Dr. Sajous of Philadelphia, and besides these medical gentlemen, Bishop Lawrence, of Massachusetts, and Messrs. Morris K. Jesup, President of the New York Chamber of Commerce; John S. Kennedy, President of the Presbyterian Hospital, of New York, and William J. Schieffelin, of New York. The following conclusions were reached: That an effort should be made to raise a memorial fund of $25,000 or more, the income to be given to the widow and daughter of Dr. Reed, and after their decease the principal to be appropriated either to the promotion of researches in Dr. Reed's special field, or to the erection of a memorial in his honor at Washington.

Arrangements were made for the publication of circulars explaining this movement, and asking co-operation not only from the medical profession, but from all liberally disposed individuals who appreciate the value of Dr. Reed's services to mankind.

NOTES ON NEW BOOKS.

A Text-Book of Chemistry for Students of Medicine, Pharmacy and Dentistry. By EDWARD CURTIS HILL, M. S., M. D., Medical Analyst and Microscopist; Professor of Chemistry and Metallurgy in the Colorado School of Dental Surgery; Professor of Chemistry and Toxicology in the Denver and Gross College of Medicine, University of Denver. Illustrated with 78 illustrations, including 9 full-page half-tone color plates. Pages xii-523. (*Philadelphia: F. A. Davis Company, Publishers, 1914-16 Cherry Street.*

This is a most convenient text-book for the use of students. It treats succinctly and clearly of medical physics, organic and inorganic chemistry, sanitary chemistry, toxicology, *physiologic* and *pathologic* chemistry and *clinic* chemistry. (The author evidently has the courage of his orthographic convictions.) The material is well arranged and made ready of access by a good index. It seems extremely well adapted to classroom use and the author has appended to each chapter or section a series of questions. We would recommend it not so much as a general text-book but as a special manual for students of medicine, pharmacy and dentistry.

Surgical Asepsis. Especially Adapted to Operations in the Home of the Patient. By HENRY B. PALMER, M. D., Consulting Surgeon to the Central Maine General Hospital. Ninety illustrations. (*Philadelphia: F. A. Davis Company, Publishers, 1914-16 Cherry Street.*)

The object of this manual of aseptic surgery is to demonstrate that good surgical work may be done by the operator in the home of the patient, with benefit to the patient and great relief to the anxiety of interested friends. The wisdom or unwisdom of home surgery depends upon so many factors which are not within the domain of pure surgery that the book cannot be considered conclusive. There is no doubt, however, that in a good home, surrounded by sensible and judicious relatives, aseptic surgery has a definite field of utility. The author wisely makes no attempt to theorize but contents himself with a clear statement of the experience of other surgeons which may sometimes seem too brief and hence misleading. In some instances as, for example, in his statement as to the safety of abandoning drainage of the abdomen in gonorrheal pus cases, a more extensive quotation from the literature might have seemed less dogmatic, leading to a safer course for the patient. A gonorrheal abdominal infection cannot be considered a slight matter. We do not see any reference to the use of silver foil as a dressing after operations. The omissions discoverable are only few and the book is to be commended as an excellent one for the practitioner and nurse.

The Practical Medicine Series of Year Books, Comprising Ten Volumes on the Year's Progress in Medicine and Surgery. Issued monthly under the general editorial charge of GUSTAVUS P. HEAD, M. D., Chicago. Vol. VII—Pediatrics. Edited by ISAAC A. ABT, M. D. (*Chicago: The Year Book Publishers, 1903.*)

This little volume may be considered a condensed *Centralblatt*. The selection of abstracts is upon the whole satisfactory and the proportion of the volume allotted to different topics seems judicious. The object of the book being to supplement the information contained in text-books by supplying recent additions to the literature of pediatrics, it serves a most useful purpose. The only criticism to be made is that the work has been too much condensed.

Organic Nervous Diseases. By M. ALLEN STARR, M. D., Ph. D., LL. D., Professor of Diseases of the Mind and Nervous System, College of Physicians and Surgeons, Medical Department of Columbia University in the City of New York, etc. Illustrated with 275 engravings in the text and 26 plates in colors and monochrome. (*New York and Philadelphia: Lea Brothers and Co., 1903.*)

This volume is based upon the clinical and pathological material which Prof. Starr has accumulated during a very active hospital and private practice extending over the past twenty years, and the book is largely a record of personal observation and experience. It is gratifying to notice that special care has been exercised throughout the book to give prominence to the question of treatment. In the mind of the author it is manifestly not enough to give clinical symptoms and pathological findings alone, and to leave the physician to struggle with the question of treatment unaided, but he has given in detail his methods of treatment and of relieving pain. His treatment of neuralgia, for example, is full and suggestive and well calculated to assist the busy practitioner who has found remedy after remedy of little avail. In the section on sciatica we fail to find arthritis assigned a prominent place as a causative agent. It certainly deserves to be regarded an important factor in the production of the disease. The chapters on the various forms of neuritis are five in number and the discussion of the subject is ample and suggestive. The chapters on the diseases of the spinal cord are very carefully written, as also are those upon diseases and injuries of the brain. In these the author has drawn upon his rich stores of experience and has produced results of great practical utility to the student and practitioner. The volume is finely printed and well illustrated. It deserves to take its place among the best text-books in English upon diseases of the nervous system.

Gynæcology: A Text-Book for Students and a Guide for Practitioners. By WM. A. PRYOR, M. D., Professor of Gynæcology in the Polyclinic Medical School. (*New York and London: D. Appleton and Co., 1903.*)

In this little text-book, written primarily for the use of students, one looks in vain for the imperative insistence upon surgical asepsis in the most trivial examinations or operations in gynæcology. Although the author repeatedly refers to infections of the uterus by the use of "filthy instruments" introduced into it, he fails to sound the warning at the outset, at the time when students are most impressionable, and the habits of life are formed. Clean hands and clean instruments in private practice or in the office, are as essential as in the operating room, and as easily obtained, and this the author fails to emphasize.

The chapter devoted to the manual examination of the patient is good, though perhaps too much abridged; but in the examina-

tion by instruments it is rather startling to find abdominal section head the list, as though it were a matter of routine practice, rather than a preliminary of probable operation, and done as a last resort.

It is to be regretted that so little space is devoted to the disorders of menstruation. A chapter devoted to it and the menopause would be a welcome one to the beginner, and following this, a somewhat more comprehensive discussion of minor gynæcologic disorders, and their treatment.

We find but twenty-four pages out of the 380 devoted to seventeen diseases of the external genitals, and they are incomplete and unsatisfactory; for instance, in describing the treatment of condylomata of the vulva and vagina, the author advises scraping or cauterizing them, and dusting with a powder, but ignores the most important element, viz., constitutional treatment, since it is doubtful whether they ever have any other than a specific origin, and wounds made upon a syphilitic subject do not heal well until the patient is under the influence of specific treatment.

In removing the tuberculous kidney and ureter, the author advises inverting the vesical stump into the bladder, and allowing it to slough away, to be washed out by daily irrigation; this appears to us a rather hazardous procedure. The chapter devoted to uterine fibroma and fibro-myomata is exceptionally good, and will be found comprehensive and practical, even if closing the cervix, to check hæmorrhage of the uterus, would appear of doubtful utility.

The greater part of the book contains much useful information, imparted in a particularly pleasing manner, and we note with sincere approbation the conservative tone which pervades the entire volume. The illustrations are exceptionally good.

In a book of this character too much has perhaps been sacrificed to brevity. Although we cannot agree with the author in everything contained in it, the book will prove a helpful although possibly not an indispensable addition to the student's library.

Lectures on Massage and Electricity in the Treatment of Disease. By Thomas Stretch Dowse, M. D., Abd., F. R. C. P., Ed. Fourth edition. (*Bristol: John Wright & Co., 1903.*)

The work is an excellent and careful exposition of the practice of massage, moderate and sensible in its tone.

The present edition contains an appendix upon modern methods in electrical treatment (in addition to the lectures upon massage and electricity) which is entirely technical and does not refer to the results thus far obtained in this branch of the science. The book is an excellent exponent of the general principles and the various forms of practice, especially of massage, which, it is evident, holds the higher place in the author's esteem: and it is readily understood that the subject must acquire under the lecturer's own hands an interest that the book can scarcely inspire. In the present state of conservative acceptation of massage into the inner circle of medical treatments, it is perhaps scarcely wise to meet the profession with a definition of massage as "The application of sentient living matter to sentient living matter," etc.; it suggests flights of fancy and statements of universal truths which are, in this country, too much associated with quackery; and justice to the author compels one to say that there is nowhere in the volume anything but plain facts of physics, physiology and methods.

The technical explanations are clear and complete, though in many instances the case reports are probably superfluous; but it is to be remembered that the lectures are set down as delivered, and in a spoken dissertation these have their place.

The chapters upon the Weir-Mitchell treatment and the Nauheim treatment of diseases of the heart are the most interesting to the average practitioner of medicine. Hysteria and neurasthenia are scarcely differentiated as much as the American physician is accustomed to see them, but the treatments are thoroughly in accord with the practice of the most successful men in these diseases, and are properly insisted upon. It would be interesting to have outlined in a future edition a line of treatment for those cases of neurasthenia, so-called, which are not nerve-exhaustion but "nerve-energy-expended-in-wrong directions" (we await the coining of a word) which are so often met in this country; probably, however, the author would not consider them as specially falling within his province.

The Anatomy of the Human Peritoneum and Abdominal Cavity Considered from the Standpoint of Development and Comparative Anatomy. By George S. Huntington, M. A., M. D., Professor of Anatomy, College of Physicians and Surgeons, Columbia University, New York. (*Philadelphia and New York: Lea Brothers & Co., 1903.*)

This magnificent and lavishly equipped volume occupies a unique place in the literature on the subject. It is beautifully printed, profusely illustrated, and while it is exhaustive in dealing with some subjects, it is fragmentary in dealing with others; through it all one feels the earnest wish of a careful teacher to impart his knowledge in the most practical manner to the student.

The author correctly emphasizes the importance of the study of embryology and comparative anatomy for the student of human adult anatomy. Studied from a purely anatomical standpoint the adult human body offers so many topographical variations from what we generally consider the usual arrangement that a full appreciation of the anatomical findings at a dissection or at an operation is often impossible. If, however, the student is familiar with the stages of development through which the human body passes before attaining the adult form, and in addition if he is well versed in a knowledge of the numerous varying types encountered in the vertebrates, he will be much better fitted to fully grasp the anatomical significance and topographical importance of a strange relationship of organs which may happen to present itself at the dissecting table or in the operating room. It is difficult for the average mind to fully comprehend the relation of the different organs of the abdominal viscera toward each other and to the peritoneal lining, the position of peritoneal folds, lines of reflection and the innumerable variations, which so often present themselves. It is likewise difficult to appreciate the topography of the intestines, and recognize in the adult form the end stage of a peculiar process of rotation of the primitive coils. Such difficulties are reduced to a minimum if the observer recalls the simple forms and relations as found in the organs of the embryo, and follows their development in form and position through the successive stages.

Huntington suggests the practical method of using the injected viscera of a cat in connection with the study of the human subject. The student should place the intestines of the cat in the same position as found in the human adult; the areas of contact thus formed correspond to the extent of fusion of the peritoneal covering of the large intestine and its mesentery with the parietal peritoneum and the upper portion of the alimentary canal as found in the human adult. The injected viscera of the cat, preserved in 5 per cent formalin or in 50 per cent alcohol, kept side by side with the human subject, will afford a pliable model and a useful guide in the study of all the complex and often obscure conditions encountered in the human viscera. Most abnormalities are easily explained as arrested fœtal development or abnormal "anlage," the degree ranging from almost imperceptible deviation from the normal to excessive malformation or malposition, or both. The most complex relationship between portions of the viscera becomes in this manner easily understood. Especially helpful is this method of study in connection with the nerve, blood, and lymph supply of the parts

concerned. Peculiar anastomosing trunks, supernumerary or misplaced vessels, are recognized as such and their meaning and cause of existence become less of a mystery. Moreover, much mental energy is wasted in trying to remember anatomical facts, such as the relationship of organs, passage of nerves and vessels, etc.; the study of embryology and comparative anatomy, however, will train the mind so that the relationship of organs receives a new meaning; the student learns why the organs were compelled to assume such a position and why this or that vessel passes dorsal and not ventral to this or that organ. Experience has shown that an empty fact to be memorized leaves less deep an impression in our mind than the recognition of a law and the finding of the underlying causes.

A large portion of the book is given to the study of comparative anatomy, and in connection with this the author has given many valuable and instructive pictures of preparations contained in the Morphological Museum of the Columbia University, which splendid collection has thus in part been rendered accessible to those not living in New York. This material, although it does not represent a complete series, is sufficient to bring into strong relief the essential points, the gradual evolution and the similarity of the early developmental stages of the organs of higher classes with the corresponding permanent structures of the lower vertebrates. The book is neither complete as an embryology nor as a presentation of the comparative anatomy of the peritoneum and abdominal cavity. A number of facts are not mentioned, discussion of theories "designedly omitted," and the extensive literature on the subject, save for a very few instances, is not quoted; all this is done doubtless with the object of maintaining clearness and brevity. While some sections, as for instance, that dealing with the ileocolic region, are elaborated at great length, occupying almost one-fourth of the entire book and containing nearly one-half of all the pictures, others have been treated with comparative brevity. An introduction, which is written in the form of an abridged embryology of the alimentary canal, prepares the reader for the subsequent chapters. These are: Part I. Anatomy of the Peritoneum and Abdominal Cavity, Anatomy of Foregut and Stomach; Part II. Anatomy of the Peritoneum in the Supracolic Compartment of the Abdomen,—(1) Stomach and Dorsal Mesogastrium, (2) Ventral Mesogastrium and Liver; Part III. Large and Small Intestine, Ileocolic Junction and Cecum,—(1) General Review of Morphology and Physiology of the Vertebrate Intestine, (2) Serial Review of the Ileocolic Junction and Connected Structures in Vertebrates, (3) Phylogeny of the Types of Ileocolic Junction and Cecum in the Vertebrate Series; Part IV. Morphology of the Human Cecum and Vermiform Appendix.

The work is essentially an atlas, the text occupying but 260 pages, while the illustrations are 582 in number, grouped on 300 full-page plates. These plates are bound in groups usually of eight at intervals throughout the book, with the text references often at a remote place—an arrangement very troublesome to the reader. A good many of the figures are simple diagrams, reproduced by the line process, or adaptable to it, which method certainly permits the picture to be printed in the text. The text which is clear and concise contains little that is new. The manner in which the intricate relationship of organs and the complex changes during their development is described, however, deserves much praise. There are frequent references to diagrams and pictures of primitive forms, with the aid of which the reader cannot help arriving at a clear understanding of the adult forms. The pictures are in a large measure original and deserve careful study. They are partly photographic reproductions of good preparations, partly drawings taken from the same source. A large number are original diagrams, illustrating in a simple manner the topographical evolution from the primitive to the final adult condition. Without these the text would indeed be difficult to peruse, and if they had been printed in the text instead of on plates, as was mentioned before, the reader's task might have been simplified. Some are copied, others redrawn, slightly modified, from the standard books, not always, however, with judicious discrimination, and inferior diagrams are given where the literature could have furnished superior ones.

Taken as a whole, the book deserves to be carefully studied. The student of embryology and anatomy will find its contents a valuable supplement to his knowledge; the surgeon, a means of arriving at a better appreciation of the anatomy of the abdominal viscera and their innumerable variations.

A Text-Book of the Practice of Medicine. By J. M. ANDERS, M. D. (*W. B. Saunders and Co., 1903.*)

In writing the annual review of Dr. Anders' text-book, the reviewer has to beware lest repetition render him careless. A new edition appears almost as regularly as the Year Book of Medicine. The success of this work is well deserved. In the present edition there are no changes requiring special mention. We are unable to agree with the author as to the value of his tables of differential diagnosis. They savor too much of the quiz-compend. Such methods of learning diagnosis are little likely to be of use at the bedside. We doubt if the author uses them himself, however strongly he may advise their use to the student with an examination in view. The sections on treatment are excellent and add greatly to the value of this work. Dr. Anders is to be congratulated on the continued success of his text-book.

Clinical Methods: A Guide to the Practical Study of Medicine. By ROBERT HUTCHISON, M. D., M. R. C. P., Assistant Physician to the London Hospital, etc., and HARRY RAINY, M. A., F. R. C. P. Ed., F. R. S. E., University Tutor in Clinical Medicine, Royal Infirmary, Edinburgh. (Fifth Edition. *Chicago: W. T. Keener and Co., 1902.*)

This excellent little work has now reached its ninth thousand, a fact which may be taken as a convincing proof of the high esteem in which it is held. In the present new edition, among the parts that have been practically rewritten are the sections dealing with the clinical examination of the blood and the nervous system. The latter, more especially, is worthy of the highest praise for its combination of thoroughness, lucidity and conciseness. The chapter on clinical bacteriology has also been revised. As a whole the work is a most valuable one. The writers have succeeded in condensing their material and still presenting it in a very readable style; it would perhaps be difficult to find elsewhere such a fund of useful and practical information contained in the present compact and handy volume.

Ambulance Work and Nursing: A Handbook on First Aid to the Injured, with a section on Nursing, etc. Profusely illustrated. (*Chicago: W. T. Keener and Co.*)

This work is prepared for the instruction of ambulance classes and aims to give instruction as to first aid. It is profusely illustrated and the pictures are really helpful. The section upon nursing is eminently practical, although probably better adapted to conditions in England than in America. We regret to observe an undertone of disparagement of anything beyond the purely practical training of the nurse. The present system of training nurses, it should be remembered, is in fact a protest against the purely practical training which nurses formerly received. If theoretical knowledge is not imparted along with her practical training the nurse must inevitably cease to progress in her work as soon as her period of training is over. The book contains much which will be eminently useful even among those who do not

aspire to be trained nurses. The volume should be more durably bound if it is to be used in the household.

Nurses Guide to Surgical Bandaging and Dressings. By Wm. Johnson Smith, F. R. C. S., Principal Medical Officer, Seamen's Hospital, Greenwich. (*Philadelphia: J. B. Lippincott Company. London: The Scientific Press, Limited.*)

This title of this admirable little book is misleading and strangely inadequate. Instead of confining itself to the dry and unsatisfactory details of bandaging, it is really an excellent manual for antiseptic surgery. It treats of "the modern treatment of wounds," of "wound infection and sepsis," of "antiseptic and aseptic surgery," of "the antiseptic treatment of wounds" of "the operating room and its contents," of "preparations for surgical operations," of "the treatment of wounds," of "the treatment of ulcers," of "nursing in injuries," and of "the temperature and pulse," as well as of "surgical bandaging," etc. It is attractively printed and convenient in form. The directions contained in the book are in plain scientific language and no attempt has been made to render them too simple. It may be commended for the use of nurses and all who have to do with the sick or injured.

Disease of the Pancreas. Its Cause and Nature. By Eugene L. Opie, M. D., pp. 359. (*Philadelphia and London: J. B. Lippincott Company, 1903.*)

It is a pleasure in this day of many text-books, when each publisher's list independently boasts of at least one in every department of medicine, to find a book such as this, which comes not because the publisher needed a book on that subject, but because the author knew fresh things and saw other things more clearly than his predecessors. This is no mere collection of facts, either, that merely adds to the rough material from which someone else might construct the clear picture of the disease. It is the chief merit of the book that the values and broad relations of the facts are appreciated, anatomical and experimental observations being made to serve their full purpose in the elucidation of each of the several conditions considered.

The anatomy of the pancreas with its variations occupies the first three chapters, in which much that is new may be learnt of the arrangements of the ducts, of the origin and relations of aberrant pancreatic masses, as well as of the nature of the curious islands of Langerhans, whose significance receives special emphasis throughout the remainder of the volume. Following this are chapters on the acute forms of pancreatitis, with the results of diffusion of the pancreatic secretion in producing fat necroses. Especially important in these chapters is the explanation of the production in cases of cholelithiasis of the acute hæmorrhagic pancreatitis by the occlusion of the orifice of the diverticulum of Vater which in some instances may divert the bile into the pancreatic duct and thus produce the lesion. Objections to this are being made on the ground that the muscular sphincter fibres of the pancreatic duct are too powerful to allow the entrance of bile, but this is merely another instance in which theory is opposed to obvious facts.

Succeeding chapters deal with the varieties and etiology of chronic interstitial pancreatitis, in association with one form of which, the interacinar, the islands of Langerhans may be involved. More important perhaps than this is the discussion of the occurrence in several cases of hyaline degeneration affecting chiefly the islands of Langerhans, in which cases diabetes existed. The islands are conceived of as being analogous to other ductless glands such as the thyroid, and controlling not the proteid metabolism but that of the carbohydrates. Their destruction is therefore held responsible for the alterations in the sugar metabolism in diabetes. On account of their size and position these islands are hardly accessible to direct experimental study, but the cases described present the results of their extirpation as clearly as any experiment could.

A further chapter deals with hæmachromatoses and bronzed diabetes, after which a summary of all is given in the endeavor to make a practical application of the results.

We have reason to be proud that such a book has been written by an American, for, aside from the care and ingenuity evidenced in the anatomical observations and the experiments, there has been preserved such an attitude of rigid self-criticism that one may feel sure that nothing in the book will be regretted.

Protozoa and Disease. Part I. By J. Jackson Clarke, M. B. (London). *New York: William Wood and Co., 1903.*)

This little book of one hundred and seventy-seven pages "has been written to bring together the salient points of what has been already definitely ascertained with regard to the protozoa as parasites and pathogenetic organisms."

In the introductory chapter dealing with unicellular organisms in general, the author gives an elementary and unsatisfactory description of the structures and process of division of the cell. Seven of the succeeding chapters are devoted to a consideration of the characteristics of the various protozoa and of the diseases caused by them. It is of interest to note that the malarial organism is still not located "taxonomically." The life history of this organism, especially of *Plasmodium præcox*, is considered in some detail. In the light of the recent work demonstrating the part played by the mosquito as intermediary host the life history is divided into an asexual phase occurring in man and the sexual phase occurring in the alimentary canal of *Anopheles*. To W. G. MacCallum credit is given of having first observed the process of fertilization in this order of organisms. In a brief chapter the little known concerning diseases of protozoa is considered. And then the book is concluded with a description of methods used in the study of unicellular organisms.

The reviewer is struck by the air of incompleteness the book has about it, possibly more the result of the fragmentary state of our knowledge rather than of omission on the part of the author. It is also possible that the second part, in which "it is proposed to collect the work that has been done with regard to the part alleged, but not yet fully proved, to be played by protozoa in disease . . ." may round out what appears incomplete in the first. It is, however, certain that the author does not present the classification of protozoa as clearly as he might. The relation of organisms one to another, i. e., the distinction of class, subclass and order, is more or less completely slurred over. The book, however, contains much valuable and interesting information illustrated by means of many well-chosen cuts, and certainly it will be relished by those not particularly familiar with the part played by protozoa in disease.

A Text-Book of Pathology. By Alfred Stengel, M. D., Professor of Clinical Medicine in the University of Pennsylvania. Octavo volume of 933 pages, with 394 text-illustrations, many in colors, and 7 full-page colored plates. (*Philadelphia, New York, London: W. B. Saunders and Company, 1903.*)

This work as stated in the preface is an attempt to present the subject of Pathology from the point of view of the clinical pathologist. As the book has already gone through three editions it hardly needs an introduction to those interested in Pathology. In the present edition various chapters have been retouched and partially rewritten where recent investigation made it imperative, and on the whole the edition is an advance over those preceding it, yet it has not eliminated their faults. In the opinion of the reviewer the book is too comprehensive and the author has made this last edition more so by the addition of a chapter on "Pathologic" Technique, a chapter entirely superfluous in a book not suited for laboratory use. As a result of the endeavor to

cover too much ground, one finds the descriptions are cursory, the forms of expression are often careless and obscure. It lacks the exactness and precision one is accustomed to find in the more scientific text-books, and its general arrangement of subject matter is loose. As examples of the latter failing, one finds, under the general heading "Bacteria and Diseases due to Bacteria," subhead "Diseases of Certain Bacteriology," lying between a chapter headed "Typhoid Fever" and one headed "Cholera," a chapter with the heading "Bacillus Coli Communis"; under the same subhead we find a chapter on "Mycetoma," caused by "an organism of an uncertain biologic class"; also one on "Influenza" of which the author says, "the specific character of the organism is inferred rather than demonstrated," and this same reason serves to place "whooping-cough" and "Malta fever" in the class of "Diseases of Uncertain Bacteriology." In this latter class the author still includes "yellow-fever" although accepting the evidence for the importance of the mosquito in the transmission of the disease, and the necessity of an incubation period after the infection of the mosquito, before it is capable of transmitting the disease, a fact which almost certainly precludes the possibility of its being a bacterial disease. While these points may seem trivial, they are the straws which indicate. Without going more into detail, it may be said the book seems one adapted to the needs of those who desire only general information on the subjects treated, and thus probably more suitable for the practitioner than for the student, unless one were sure the student would be inspired by reading the book to look further for more exact information.

The Practical Application of Röntgen Rays in Therapeutics and Diagnosis. By WM. A. PUSEY, A. M., M. D., Professor of Dermatology in the University of Illinois, and EUGENE M. CALDWELL, B. S., Director of the Edward N. Gibbs X-ray Laboratory. (*Philadelphia: W. B. Saunders and Co., 1903.*)

The appearance of this work has supplied a long felt need in X-ray literature. It has been the aim of the authors to treat the entire subject not only in a scientific way but also in a practical manner. The subject matter is divided into two parts. Part I deals entirely with the technical side of X-ray work. A chapter is given to each separate part of a good equipment. The various styles of apparatus are discussed and their good and bad points enumerated. Under every head a number of suggestions are made which not only are of great help to the beginner but could also be well borne in mind by experienced radiographers. This part should prove of especial value to beginners as it throws light upon the very points where difficulty is most likely to be experienced.

Part II is devoted to the consideration of the therapeutical results. The first few chapters deal with burns and the resulting pathological changes in the skin. The treatment of these burns furnishes the text for a very important chapter. The point is emphasized that the usual treatment is entirely too vigorous. Bland, or at the most, only mildly stimulating ointments should be used.

The remaining chapters devoted to the treatment of various diseases are especially instructive. We not only get the benefit of the author's great personal experience, but then too all authentic X-ray literature has been carefully sifted over and we are given the general results.

In reading the work one is impressed with the fact that the authors are most enthusiastic over the future possibilities of the therapeutic effect of the X-ray; at the same time the subject has been dealt with in an impartial and fair-minded way.

It is by far the best general treatise that has appeared. Presenting as it does the very latest advances in X-ray therapeutics and diagnosis, it should be in the hands of all radiographers.

Consumption a Preventable and Curable Disease: What a Layman Should Know about It. By LAWRENCE F. FLICK, M. D., Founder of the Pennsylvania Society for the Prevention of Tuberculosis; President of the Free Hospital for Poor Consumptives of Pennsylvania; Medical Director of the Henry Phipps Institute for the Study, Prevention and Treatment of Tuberculosis. (*Philadelphia: David McKay, 1903.*)

In the present crusade against tuberculosis much credit is due to the lay press for the efficient aid it has rendered in the cause of preventive medicine. Unfortunately, however, with the laudable desire of arousing the public to a sense of the importance of the problem which confronts it, a zealous enthusiasm has sometimes overstepped the boundaries of fact, with the result, as Dr. Flick has well put it, "that the public has been thrown into a panic, so that people turn out the poor consumptive as a pariah without regard to what shall become of him." The present work, therefore, is to be welcomed as a timely exposition addressed to the layman of our present knowledge concerning tuberculosis and consumption, its origin, nature, treatment and prevention. While clearly stating that consumption is a communicable disease Dr. Flick discusses carefully the amount of risk in the home, store, office, church, public conveyances and elsewhere, and shows that with careful, but at the same time simple and by no means burdensome, precautions the tuberculous patient may still live in the world without being a menace to his fellows.

In dealing with a scientific subject from a popular standpoint errors of omission and commission are inevitable and too strict a criticism would savor of captiousness. Nevertheless, it might have been well to have devoted a few pages at least to demonstrating the perniciousness of the various consumption cures, which, even when not directly harmful in themselves, prevent the patients from adopting appropriate measures in time and leave the poorer sufferers without means of providing for themselves opportunities for obtaining an abundance of good food and fresh air. Again, although the question of immunity is naturally of the greatest interest, it would seem inadvisable to express opinions so dogmatic as those found in Chapter XVI on a subject about which scientists are by no means agreed. On the whole, however, the defects in the present book are few, and it should be heartily welcomed as an important aid in educating the layman.

American Edition of Nothnagel's Practice: Diseases of the Stomach. By DR. F. RIEGEL, of Giessen. Edited with additions by CHARLES G. STOCKTON, M. D., Professor of Medicine in the University of Buffalo. Octavo volume of 835 pages, illustrated, including six full-page plates. (*W. B. Saunders and Company, 1903.*)

The present volume contains a full exposition of what is known to-day of morbid conditions affecting the stomach. The subject is treated of under two main headings: (I) General Diagnosis and Treatment of Diseases of the Stomach; (II) Special Diagnosis and Treatment of Diseases of the Stomach. Throughout are seen evidences of a master mind and a ripe experience which have been able to sift the unessential from the essential, so that while insisting upon thoroughness in principle and practice we find the author imbued with a proper conservatism which recognizes the uselessness and inadvisability of certain meddlesome tactics which in the past have done much to add to the labors and sorrows of the dyspeptic instead of alleviating his troubles. Every general practitioner ought to be trained in the various methods by which alone a proper diagnosis of any stomach disorder can be arrived at with certainty, but it is a matter of every-day experience to meet with cases in which the stomach tube has been abused and in consequence the patient has been almost starved to death or has become a hypochondriacal wreck.

Riegel has struck the happy mean and the present work is

inspiriting from the amount of sound common sense which is incorporated with erudition and an almost unexampled fund of practical experience. Throughout practical therapeusis is the keynote, although all important theories are discussed with a lucidity which adds much to the interest of the reader, and enables him to attain to a broad standpoint on the subject which he may not have been able to acquire from other works. It is possible that the arrangement of the work is responsible for here and there a certain amount of needless repetition, but this defect is hardly noticed, and, to say the least, the repetition seems in most cases to be appropriate and serves to emphasize important points.

The American editor has done his part of the work admirably. His additions and remarks are appropriate and add much to the value of a work which has already many of the elements of perfection.

The book does not lend itself readily to a detailed criticism. Containing as it does so much that is valuable and essential for the general practitioner as well as for the specialist, it should be read carefully as a text-book and later take its place on the most convenient shelf in the library whence it can be readily taken down for reference in the course of every-day practice.

A Dictionary of Medical Science, containing a full explanation of the various subjects and terms of Anatomy, Physiology, Medical Chemistry, Pharmacy, Pharmacology, Therapeutics, Medicine, Hygiene, Dietetics, Pathology, Bacteriology, Surgery, Ophthalmology, Otology, Laryngology, Dermatology, Gynecology, Obstetrics, Pediatrics, Medical Jurisprudence, Dentistry, Veterinary Science, etc. By ROBLEY DUNGLISON, M. D., LL. D. Twenty-third edition. Thoroughly revised, with the pronunciation, accentuation and derivation of the terms. By THOMAS L. STEDMAN, A. M., M. D. (*Philadelphia and New York: Lea Brothers and Co., 1903.*)

The American Illustrated Medical Dictionary. For Practitioners and Students. A Complete Dictionary of the Terms used in Medicine, Surgery, Pharmacy, Chemistry, and the kindred branches, including much collateral information of an encyclopedic character, together with new and elaborate tables of Arteries, Muscles, Nerves, Veins, etc.; of Bacilli, Bacteria, Micrococci, Streptococci; Eponymic Tables of Diseases, Operations, Signs and Symptoms, Stains, Tests, Methods of Treatment, etc., etc. By W. A. NEWMAN DORLAND, A. M., M. D., editor of the "American Pocket Medical Dictionary." Large octavo, nearly 800 pages, bound in full flexible leather. Third edition. Revised and enlarged. (*Philadelphia, New York, London: W. B. Saunders and Company, 1903.*)

A Thesaurus of Medical Words and Phrases. By WILFRED M. BARTON, M. D., Assistant to Professor of Materia Medica and Therapeutics, and Lecturer on Pharmacy, Georgetown University, Washington, D. C.; and WALTER A. WELLS, M. D., Demonstrator of Laryngology and Rhinology, Georgetown University, Washington, D. C. Octavo of 534 pages. (*Philadelphia, New York, London: W. B. Saunders and Company, 1903.*) Flexible leather.

The American Pocket Medical Dictionary. Edited by W. A. NEWMAN DORLAND, M. D., Assistant Obstetrician to the Hospital of the University of Pennsylvania. Containing the pronunciation and definition of the principal words used in medicine and kindred sciences, wth 566 pages and 64 extensive tables. Fourth revised edition, greatly enlarged. (*Philadelphia, New York, London: W. B. Saunders and Company, 1903.*) Flexible leather, with gold edges, $1.00 net.

The Practical Medicine Series of Year Books. Vol. IX. Physiology, Bacteriology, Anatomy and Dictionary. Edited by W. A. EVANS, M. S., M. D., ADOLPH GEHRMAN, M. D., WILLIAM HEALY, A. B., M. D. (*Chicago: The Year Book Publishers, 40 Dearborn Street, August, 1903.*)

The industry of authors and the enterprise of medical publishers have given physicians these admirable aids to study. They are unusually well arranged and carefully edited and their clear letter-press and neat and tasteful binding render them attractive books for the student's desk.

Dunglison's well known *Dictionary of Medicine* has been before the medical public for nearly three-quarters of a century, and during this period it has probably been consulted by more persons than any other work of a similar character. In the twenty-third edition which is before us the editor has subjected it to a careful revision, eliminating many obsolete words and supplying many new medical terms. As a rule the work has been extremely well done and the result of his labor is a volume of great usefulness to the physician and medical student. The definitions are concise and well suited to the needs of medical students. Some of them are faulty. The definition of epinephrin, "a powder prepared from the adrenal gland," might be criticised as vague and unsatisfactory. Sajous' theory that the ductless glands are active agents in all oxidation processes is also referred to in the definition of the adrenal gland as an established fact rather than as a hypothesis which has not yet been accepted by scientific men. The list of bacteria is seemingly very complete. Under the head of stains we notice no reference to Mallory's or Van Giesson's, although they are much used in pathological investigations. "Dietel's crisis" and "dementia præcox" among other words also are not included in the list of words. These, however, are minor defects and will not seriously mar the excellence of the work. The volume of 1212 pages is well printed and attractively illustrated. It seems especially well adapted to the needs of the medical student and is destined to renew its old time popularity.

The *American Illustrated Dictionary* has on two previous occasions received favorable notice in the pages of the BULLETIN. The present third edition has been much amplified by the addition of about thirty pages of fresh material. It is now very complete. In the list of bacteria and in staining methods employed for bacteriological and pathological study it is exceptionally full and useful. Its clear type, convenient size, flexible covers and attractive appearance render it admirably fitted for ready reference on the part of the reader.

The *Thesaurus of Medical Words and Phrases* seems to have been designed by its authors to improve the diction of medical authors and to add variety to their vocabulary in their efforts to describe disease. Its range of usefulness is of necessity restricted, but it is conscientiously and carefully prepared and will find a permanent place. In the main the selection of words is judicious and well calculated to add clearness and definiteness to medical phraseology.

The American Pocket Medical Dictionary is in its fourth edition. It contains nearly 600 pages and is the American Illustrated Dictionary referred to above in miniature. It contains many thousand new words and also a variety of useful tables. It is difficult to see how more knowledge about medical words and phrases could have been compressed into the same space.

The *Dictionary of New Medical Words of the Practical Medicine Series*, by WILLIAM HEALY, is avowedly based upon the second edition of the American Illustrated Dictionary and probably confines itself to the new words contained therein. It comprises about 30 pages and seems only intended to be a vocabularly for the volumes of the Series. As such it must be distinctly helpful to its readers.

The Practical Medicine Series of Year Books. Comprising ten volumes of the year's progress in Medicine and Surgery. Issued monthly, under the general editorial charge of GUSTAVUS P. HEAD, M. D., Professor of Laryngology and Rhinology, Chicago Post-Graduate Medical School. Volume VIII. Materia Medica and Therapeutics, Preventive Medicine, Climatology, Suggestive Therapeutics, Forensic Medicine. Edited by GEORGE F. BUTLER, Ph. G., M. D., Professor of Materia Medica and Therapeutics, College of Physicians and Surgeons, Chicago, HENRY B. FAVILL, A. B., M. D., Professor of Therapeutics and Preventive Medicine, Rush Medical College, and others. (*Chicago: The Year Book Publishers, 1903.*)

The present volume consisting of 326 pages is quite up to the standard of those that have preceded it. Among the more interesting paragraphs are those that deal with the uses of cocaine, serum, therapy and the X-ray. Inasmuch, however, as abstracts of abstracts must of necessity partake of the nature of "dry bones," books of this nature do not lend themselves readily to review. Let it suffice to say here that the present volume is well worth reading and can be made to serve as an index to the busy practitioner of not a few articles that are worthy of further study and should be read in the original.

Diseases of the Skin: Their Description, Pathology, Diagnosis and Treatment. By H. RADCLIFFE-CROCKER, M. D. (London), F. R. C. P. Third edition. Revised and enlarged. (*Philadelphia: P. Blackiston's Son and Co., 1903.*)

Over ten years have elapsed since the second edition of this work was given to the medical profession, and during that time so much has been accomplished in dermatology that almost every article has been rewritten, and the volume is almost a new book. This arduous labor, however, is well compensated by the clearness and completeness of the presentation of the clinical side of skin diseases.

Over fifty new articles have been added, the majority, however, receiving only a minor consideration. Among the new diseases may be mentioned erysipeloid, X-ray dermatitis, alopecia seborrhoica and blastomycosis hominis.

A marked change is seen in the author's classification of dermatoses. Leutigo, chloasma and argyria have been taken from hypertrophies; albinism and leucoderma from atrophies, and united under a new class—anomalies of pigmentation. The parasitic diseases have been divided into two classes—hyphomycetic and animal—instead of one class with two subdivisions.

The advance in our knowledge of the pathology of diseases of the skin is shown, to some extent, by the change in classification of some of the diseases; thus adenoma sebaceum has been taken from dieases of the appendages and placed under new growths; verruca necrogenica from inflammations and classed with other tuberculides under new growths; conglomerative pustular folliculitis from inflammations and classed under hyphomycetic parasites.

In the interest of a uniform nomenclature, many of the old names have been changed in the new volume. Hydroa herpetiformis has given place to dermatitis herpetiformis, pityriasis rubra pilaris to lichen acuminatitis and tylosis palmæ et plantæ to keratosis palmæ et plantæ.

The reference literature is well selected and thoroughly opens up the subject, but some carelessness is shown in its presentation, as on quite a number of pages the references are interchanged.

A colored plate of the syphilitic eruptions and two plates of the ringworm fungi have been added, together with a few illustrations, chiefly of a pathological nature. The lack of sufficient illustrations is one of the disappointing features of the book and will probably prevent its being recommended widely as a textbook, notwithstanding its many other excellent features.

A short section on the clinical examination and standing of bacilli and fungi, by Mr. George Pernet, has been added to the appendix.

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Gynæcology. A Text-Book for Students and a Guide for Practitioners. By William R. Pryor, M. D. One hundred and sixty-three illustrations in the text. 1903. 8vo. 380 pages. D. Appleton & Company, New York and London.

Diseases and Injuries of the Eye. With their Medical and Surgical Treatment. By George Lawson, F. R. C. S. Eng. Sixth edition, with 249 illustrations. Revised and in great measure rewritten by Arnold Lawson, F. R. C. S. Eng. 1903. 8vo. xx + 587 pages. Smith, Elder & Company, London.

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